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Teacher's Guide
Level 3 – Book 1

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MATHEMATICS
LEARNING SYST[illegible]

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Teacher's Guide
Level 3 Book 1

SRA MATHEMATICS LEARNING SYSTEM TEXT

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SRA

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▲ Where teachers and students worked with consultants as part of the prepublication study: Los Angeles City Unified School District; Oakland (Calif.) Unified School District; Aurora (Colo.) Public Schools; Atlanta (Ga.) Public Schools; Winnetka (Ill.) Public Schools; Elkhart (Ind.) Community Schools; Quincy (Mass.) Public Schools; Board of Education of the City of New York (Brooklyn); Galveston (Tex.) Independent School District; and Metropolitan Separate School Board (Toronto, Canada). They shared in the development of the program.

• Locations of schools that participated in the second year of prepublication testing. They verified the revision of the first year's materials.

★ Locations of authors of the SRA MATHEMATICS LEARNING SYSTEM

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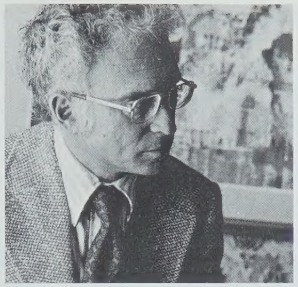
introducing the authors

M. Vere DeVault
Professor of curriculum and instruction at the University of Wisconsin. He brought to the program a comprehensive knowledge of mathematics education, teacher education, and instructional systems, as well as elementary school teaching experience and writing skill.



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Professor and chairman, Department of Mathematics at the University of Denver and head of Denver Research Institute's Mathematical Sciences Division. He has given of his professional experience in applied mathematics, guided by the conviction that mathematics must be viewed by students as meaningful and applicable.

Helen Frehmeyer
Master teacher and educational consultant, totally involved with teacher training throughout the United States and Canada. She has drawn on her vital, practical knowledge of the needs of schools, parents, teachers, and students in the contemporary school environment.

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Director of the Mathematics Institute and professor of mathematics at Boston College. He has provided his expertise as an outstanding academic mathematician. Involved for many years with the training of teachers, he is respected for his outspoken positions on the direction of mathematics education.

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Thank You

Science Research Associates, Inc., and the authors want to say THANK YOU to a group of people who helped tremendously in the development of this system. The whole thing started way back in 1969.

Juanita Tolson, experienced public school and college educator in Washington, D.C., and J. Fred Weaver, author and professor at the University of Wisconsin, were asked to review SRA's existing basal mathematics program, tell us bluntly what was wrong with it, and recommend what should be in the next basal series. They did. We listened.

Jeremy Kilpatrick, Columbia University Teachers College, was asked to share his knowledge of problem solving in elementary mathematics and tell us what could be done to improve problem-solving materials. This was a hard job. He tried. We tried.

Classroom teachers Norma Jean Cheek, Joy Craig, Fran Engelbrecht, and Jane Hawley tried out new ideas before manuscript was prepared for field testing.

John C. Egsgard, well-known Canadian educator, helped us think through the best way to develop the geometry strand so that applications would be natural and valid. He brought to our attention the outstanding work done by the Ontario Institute of Curriculum Studies and unselfishly shared his own thoughts and efforts.

George T. Duncan, University of California at Davis, was asked to do a huge job: to construct the probability and statistics strand for the entire program. His approach was refreshingly simple and understandable. It's not every day that you can find a specialist in this area who can have empathy for the young child and his thinking process and yet handle the subject with expertise.

Jerome D. Kaplan guided the work of gifted educator-writers from Educational Analysis and Evaluation, Inc., who prepared some of the chapters.

Irving Morrisett, of the Social Science Educational Consortium, was asked to react to an approach involving economics. He said don't. We didn't.

Teachers from the Montreal Catholic School Commission and William Bober, supervisor of mathematics for the Edmonton Catholic School Board, tackled the huge job of reviewing all of the final, revised manuscript used in the verification study. Their efforts gave us still more information to consider as the pages received their finishing touches.

The Mary Beck School, Elkhart, Indiana, put the verification-study materials into their nongraded, personalized education structure. They gave us insight into the various management techniques that could be used with these materials. Charles Walker assisted us from an administrator's point of view. Leo Anglin, consultant in the developmental tryout, transferred his efforts and enthusiasm to the verification study.

Ralph W. Tyler, trustee and director emeritus of the Center for Advanced Study in the Behavioral Sciences, has given generously of his time and ideas to the people directly responsible for developing this program. His knowledge of today's problems and his dream of tomorrow's education encouraged us every step of the way.

We couldn't possibly find the right words to thank all the people in the developmental field-study schools who worked so hard and responded so honestly throughout 1971 and 1972. It's hard to tell who was the most blunt, the 75 teachers or the 2700 kids. They told us what was wrong—and what was right.

The information from nearly 700 teachers and 20,000 students in schools throughout the United States and Canada who participated in the 1972/73 verification study gave confidence that the revision of the first year's testing was effective.

Other teachers dug into their bag of tricks and contributed tried and tested classroom activities. Many thanks to James K. Bidwell, Philip Cox, Thomas S. Davis, Frances Greenberg, Muriel Greig, Bettye Hall, Donald Kamp, Evelyn Kozar, Kay Nebel, David O'Neil, Louise Petermann, Madolyn Reed, William Swart, and Judy Tate.

Literally hundreds of people in SRA have shared in the development of the SRA MATHEMATICS LEARNING SYSTEM. They all cared enough to do their very best. The editorial staff did even more. Special thanks to those exceptionally talented and dedicated people.

Preface

How was the SRA MATHEMATICS LEARNING SYSTEM *developed?* Writing was almost the last step. We started by listening.

We visited schools of all kinds, from the inner city to remote rural areas. We sat in classrooms. Teachers, children, and parents told us about what they liked and didn't like about math programs.

We asked an independent research organization to interview supervisors and administrators. We talked to SRA Staff Associates about the needs they saw.

We reviewed all major basal math series. We studied standardized tests to see what children might be expected to know at various ages. Consultants evaluated existing SRA programs.

We also analyzed recommendations and reports from curriculum study groups, state and city adoption committees, and researchers in a variety of fields.

Then our authors, editors, and consultants worked together to prepare the rationale and learning objectives for the SRA MATHEMATICS LEARNING SYSTEM. Writing of the program did not begin until the entire scope and sequence had been defined by the learning objectives.

The manuscript was continuously reviewed, discussed, and revised by our development team. But it's arrogant for adults to sit in an office and predict what will work in the classroom. We needed answers to three questions:

- Will pupils attain the objectives?
- Will pupils develop positive attitudes toward the program?
- Will teachers find the program easy to use?

Our next step was to undertake two years of prepublication tryouts. We carefully selected classrooms across the United States and Canada to represent the broad range of pupil abilities, family backgrounds, and teaching styles. We visited, surveyed, listened, and tested. We rewrote and revised and retested before going to press with the program you see today.

We're confident that you'll find the SRA MATHEMATICS LEARNING SYSTEM effective, enjoyable, and easy to use. One of our tryout pupils wrote:

I liked the program and nothing was hard or dificalt. I think the book should come out to the world.

What makes the SRA MATHEMATICS LEARNING SYSTEM *a "system"?* The word *system* has many definitions. We call the SRA MATHEMATICS LEARNING SYSTEM a system because of the following five characteristics:

1. The entire program is based upon well-defined learning objectives.
2. Although the program can be enriched in many ways, the texts are complete in themselves. The teacher is not required to use any other materials.
3. There is a comprehensive evaluation program in each text.
4. Learning alternatives are provided for teachers and pupils who wish to use them.
5. The program provides information about the learners that will guide the teacher in altering or expanding a learning sequence.

What kind of objectives are there? Objectives are given for each chapter. Key to the program, however, are the year-end mastery objectives. These are the goals toward which instruction is directed.

Distinguished educator Ralph Tyler helped with the difficult task of defining learning objectives. He told us: "Remember the purpose of objectives. They are to guide, not dictate. Think of them as goals to be reached as a result of the teaching-learning process.

"Keep the number of objectives for any level under thirty, if possible. The teacher should be able to remember them all. A teacher who has to search through hundreds of objectives to figure out what to do cannot be free to teach anything more than bits and pieces.

"Avoid fashionable formulas for writing objectives. Fashions change. Avoid jargon. Keep the language simple. Objectives have to say something or their value is lost."

I liked the whole book because it told me things that I didn't even know about and it was very interesting

What are the texts like? The SRA MATHEMATICS LEARNING SYSTEM focuses on the real world and develops many concepts from real-world situations.

Compared with other programs, this program spends a longer time on an idea and its related skills before introducing another topic. This gives skill competency a better chance to develop.

I like the S.R.A. math book because it's not just plane 5x3 it you can gives you more time to think.

There are many invitations for pupils to *think* as well as to do. Not all questions are meant to be answered. Some questions have many answers; some have none.

I liked this section. They had fun math sentences. And they made you think. Math is getting a lot eazer and its funner to, math really is fun

The language is informal. Purists may object to this departure from standard textbook English, but our tryout pupils responded enthusiastically to the style. Instead of stressing technical vocabulary and symbols, the program emphasizes skills and nonverbal understanding.

No pupil should have to moan, "Aw! It's the same old stuff," when he flips through his math book. The pages of the SRA MATHEMATICS LEARNING SYSTEM are varied. They're lively. They look like fun.

How are the texts organized? There are three major types of chapters.

Exploratory In an exploratory chapter pupils play with a big idea, think about it, and share their own ideas. The necessary vocabulary is introduced, along with some of the notation and operations related to the major idea.

Instructional In this type of chapter pupils begin the serious business of acquiring skills. Ideas are carefully sequenced into learning steps, and each learning step is accompanied by practice.

Review Here pupils must demonstrate understanding and skills. There is a review of the learning sequence, along with opportunities to explore applications.

No one text contains all three types of chapters for a single concept strand. For example, there are exploratory and instructional chapters on addition of whole numbers in level 1. The instructional chapters continue through level 4, and the review chapters start at level 5.

How are pupils evaluated? The evaluation program is built into each text. It allows a learner to check his own progress and determine his own strengths and weaknesses.

The first pages of an instructional chapter contain an informal survey to find out what the learner knows about the chapter to come. These pages indicate what the chapter is about, and they help to define the learning goal of the chapter.

The tests within an instructional chapter are called Progress Checks. A Progress Check identifies the knowledge that is a prerequisite for further work.

After learning from your math book I found this test very easy I found it easy because I learned from your book this is what made it easy.

A Progress Check can serve two functions:

1. If a pupil has gone through the preceding instructional pages, a Progress Check tells whether or not he has acquired the appropriate knowledge and skills. If he hasn't, he should try other kinds of instruction.
2. If a pupil seems to have prior knowledge of the chapter, as indicated by the survey at the start of the chapter, he may go directly to the Progress Check. It will determine if the preceding instructional pages can be skipped. If he's not successful on the test, he simply goes back to pages he skipped.

At the end of every chapter a Checkout lets the pupil and teacher know whether the learning objectives of the chapter have been reached.

What learning alternatives are there? There's a limit to the number of pages in a textbook. Beyond a certain length the book becomes too expensive and hard to use. So only a few pages can be devoted to extras for pupils who need more help or who would benefit from additional activities. To make sure these important extras are available, we've supplied a wealth of reinforcement and extension activities in the Teacher's Guides.

The SRA MATHEMATICS LEARNING SYSTEM *was built on some simple convictions.* Mathematics is relevant and vital. It's useful and interesting. Everyone should relax and enjoy it.

I like math a lot more than I did last year.

Some of the greatest learning opportunities are found in everyday things and are discovered when people talk together.

I liked the chapter because I think we learned the most and because we had a lot of discussions.

Mathematics doesn't have to be formal and abstract to be good mathematics.

I think this math is very good because I know what I'm doing

Everyone—students and teachers—should succeed in mathematics.

I liked it very much I never learned this kind of measures but I think it is good that you wrote it in the book because soon America will learn the ~~the~~ from a new kind of measure and you already are teaching it to us.

A textbook can't transmit the joy of learning as well as an enthusiastic teacher, but it can help.

Notes & Things

We have asked a lot of questions. We have listened to the answers. One set of questions had to do with how a teacher's guide should be organized.

Teachers told us they didn't like to carry a big book around all year. The one-book format discouraged them from changing the order of the chapters; yet they felt it was important to be able to freely control the sequence of study. They said that they wanted a book to stay open but that typical spiral-wire binding snagged clothing. And they also confided that it was a great feeling to complete a book (even though there was another to follow). All of that made sense to us. All the requests could be taken care of by splitting the Teacher's Guide into five booklets for each level.

Teachers also told us that they wanted the guide pages numbered the same as the pupil pages. That was not such an easy request to handle, since there are teacher resource pages at the end of each chapter and some pages of introduction to the next chapter. But that request also made sense, so we put the alphabet to work.

The pupil page number repeats at the end of a chapter like the tune of a broken record; but attached to the number is a letter, which changes to accommodate those extra guide pages. When we finally get to the first pupil page of the next chapter, the guide page number will once again match the pupil page number. This whole thing sounds terrible. But flip through the book. Keep an open mind. It won't be so bad once you get used to it.

As we listened to teachers we found that there were many possible classroom organizations. They varied from large, heterogeneous grade-level groups to small, homogeneous groups composed of pupils of different ages. It was impossible to tailor a guide to fit all kinds of organizations. But it was possible to let you know the special features of each page so that you can quickly decide how you want to use that page.

Each pupil page appears, slightly reduced in size, on the guide page. And the answers are right in place. You will find comments beside each pupil page. They will be in categories like these:

lesson The pages indicated here are related but need not all be presented on the same day. They provide the continuity of experience necessary to get an idea established.

goal The words needed to turn this goal into a behavioral or performance objective have not been printed, although they could have been. The goal simply helps you pinpoint the learning task for the page.

memo These words will tell you if a discussion is needed to get the learners started in the right direction. Or they may warn you about a potential problem or provide an explanation of why something is done the way it is. Or they may be simply a suggestion to make your work easier.

things All the materials that you'll need for the page activities are listed here.

warm-up You can guess where this label came from. If the math idea is a new one or maybe a hard one, a suggestion is made that will help get the learners ready to learn.

page 1 The comments about the page itself may be introduced with traffic-light colors and will mean about the same things.

- Caution—everyone needs most of this information, but the use of the page will vary according to the ability of individual pupils.
- Stop—think about which pupils should do this activity. Your independent learners will have no trouble, but your pupils at the other end of the performance scale may benefit much more by doing other, more appropriate activities.

As you flip through the pages you will see a few sentences in *italic type*. These sentences are intended to give you some ideas about the words you might use to talk about the page. (How many times have we all thought, "I understand, but I don't know what words to use to explain it"?) In talking, probably nobody would use the exact words that are given. They are not meant to be a script. They are offered as a guide, nothing more.

You will find the new concept-development words in SMALL CAPITAL LETTERS, and some other functional words that deserve emphasis will be in **this kind of type.**

Now flip through the book again. Notice the copy below the pupil pages. There are 3 types of activities. Each type has its special symbol—one of the international traffic signals.

The old familiar red *stop* sign will signal an activity for the youngster who simply needs more work before he goes on to a new learning goal.

The yellow *divided highway* sign signals an activity for those youngsters who can accept a challenge beyond the learning expectations of the page.

The new, blue *rest area ahead* sign signals an activity you can use with any group. This type of activity departs from the standard math work and gives everyone a chance to have a break and hopefully some fun.

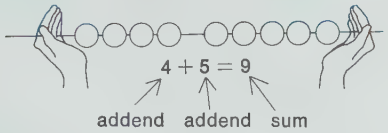
Here you will find the ideas that will extend the lessons and suggestions that offer specific help for those children who need it. Each activity was carefully selected so that you could have something special to personalize each child's learning. Most of these activities are enjoyable as well as helpful.

You'll find a Resource Section at the end of each chapter. This provides alternate forms of all progress checks and the checkout and still more activities. Not every Resource Section is the same, but you will usually find references to additional learning aids that may be in your school and are just right to use. At the end of each guide you will find a description of these learning aids. At the end of the last book you'll find a bibliography that lists children's books and film medium references. These features were planned to help you with your job of teaching and the children's job of learning.

A glossary like the one on the next page appears at the end of each pupil book. It is also reproduced at the end of each of the other Teacher's Guide books. Why not take time to look at it now, so you can get an overview of how the SRA Mathematics Learning System uses math words.

GLOSSARY

addition Putting together

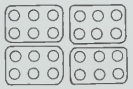


array

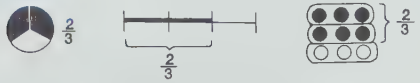
digit Any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

division

$24 \div 6 = 4$ or $6\overline{)24}$ (4 × 6), 0



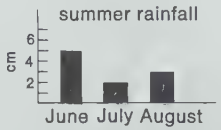
fraction A number that tells how much



$\frac{2}{3}$ ← numerator (how many parts shaded)
$\frac{2}{3}$ ← denominator (how many parts in all)

graph A way of picturing information

a bar graph:

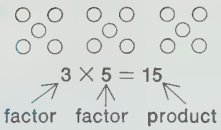


line segment A part of a line

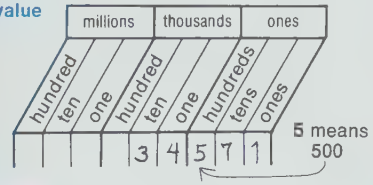
math sentence

addition: $3 + 4 = 7$
subtraction: $16 - 7 = 9$
missing factor: $3 \times \square = 12$
division: $12 \div 3 = 4$

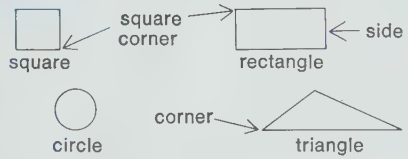
multiplication



place value

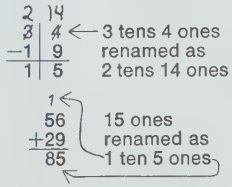


plane figure



region

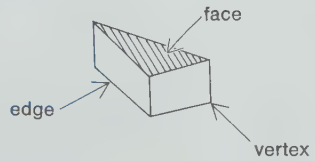
renaming



rounding

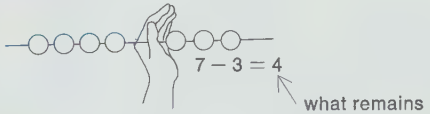
37 is closer to 40 than to 30. 37 rounds to 40.

solid object



standard unit of measure An agreed-upon length, weight, or capacity used to measure things. (See Tables of Measure.)

subtraction Taking away



symbol

+	plus	>	is greater than
−	minus	<	is less than
×	times	=	equals
÷	divided by	) ‾	division problem

symmetry Fold along the line. The two parts match.

tally chart A way to record a count

Games Won

Joe	𝍸 𝍸 ||||
Sam	𝍸 𝍸 ||

tally marks

whole number Tells how many
0, 1, 2, 3, 4, 5, and the rest of the counting numbers
even numbers—0, 2, 4, 6, and so on
odd numbers—1, 3, 5, 7, and so on

the curriculum

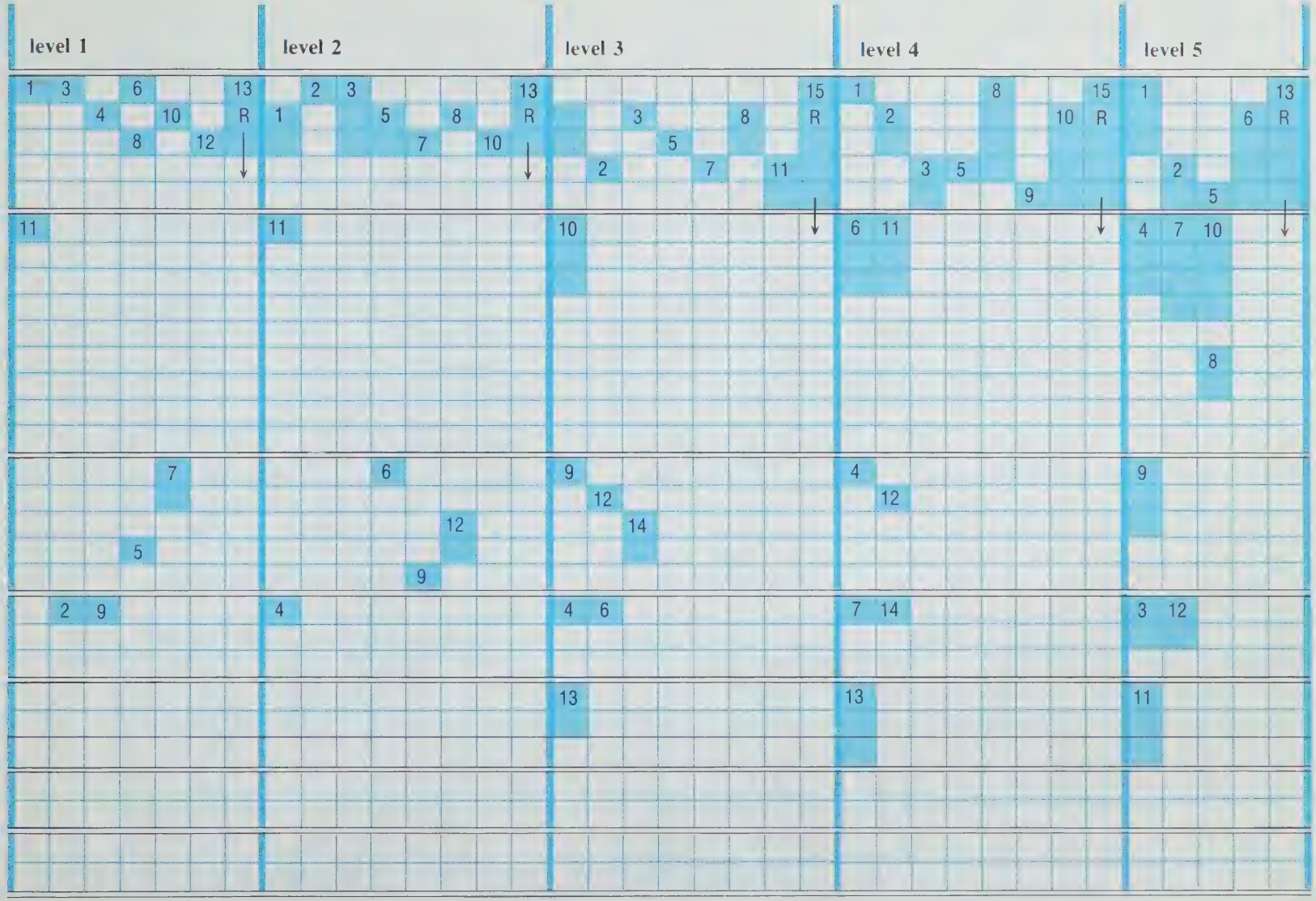
In order to maintain a balance of concept development and drill, each SRA MATHEMATICS LEARNING SYSTEM chapter is built around one big idea.

The three kinds of chapters discussed in the preface—exploratory, instructional, and review—serve to organize major mathematical ideas into continuous strands. The big-idea chapters in strand organization give you more control over the learning sequence. In cooperative planning with other teachers, you can safely change the order of chapters across several levels in order to emphasize a particular content strand at a given level.

The following chart shows the chapter organization for levels 1 through 5. Think of this chart as a road map. You will use only the part you need to get you where you want to go. The strands of content are listed down the side. The levels are listed across the top. The numeral in each rectangular shape tells the chapter number and the location of the rectangle itself signals what part of the strand's content is featured in each chapter.

If you want to emphasize the whole numbers for example, the chart will show you the sequence of the strand. If you wish to use a measurement chapter in some order other than that in the book, it's O.K. The chart indicates that certain chapters can be used much earlier than that designated by the printed sequence. Most important, the chart lets you see the flow of content from one level to another.

whole numbers	concept operations +
	−
	×
	÷
fractions	concept operations +
	−
	×
	÷
	decimal notation operations + −
	×
	÷
measurement	length weight capacity time money
geometry	3-d, 2-d shapes 1-dimensional measurement
statistics	collecting/recording interpreting information
probability	
rational and real numbers	concept operation
graphs and functions	concept application


level 1
level 2
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OBJECTIVES

This program was built upon learning objectives. Each objective clearly states what pupil behavior is to be observed, the conditions under which the pupil is to perform, and the criteria for acceptable performance.

These objectives by definition are limited to observable behavior; therefore they are limited to the cognitive domain. This is a severe limitation, for the field-test information reveals that the affective domain also has been penetrated. A greater pupil involvement in things relating to mathematics has been shown in the complete range of abilities. Attitudes have been changed. But writing objectives for the affective domain is a new endeavor, and frankly we have not yet mastered the art. The following, therefore, are learning objectives in the cognitive domain. Each objective states the performance expected at the completion of this level.

whole-number notation

1. Given any one of the numerals 0, 1, 2, 3, . . ., 9998, the learner can read it aloud; given any of these numerals aloud, the learner can write it along with the numerals that come immediately before and immediately after the given numeral.
2. Given any two numbers 0 through 9999, the learner can name a number that is between.
3. Given any 4-digit numeral, the learner can tell the value of each digit.

whole-number operations

1. Given any two 3-digit numbers, the learner can write their sum.
2. Given any two numbers from 0 to 999, the learner can write their difference.
3. Given any three 2-digit numbers, the learner can show that the way addends are grouped does not affect their sum.
4. Given a multiplication number fact, the learner can say and write the product.
5. Given a 1-digit number and a 2-digit number, the learner can find the product.

fractional-number concepts

1. Given a proper fraction with a denominator not greater than 8, the learner can make a model to represent the fraction; given a model (a number line or a region) divided into parts, the learner can say and write the fraction associated with marked parts.
2. Given two fractions with like denominators not greater than 8, the learner can compare them by saying "more than," "less than," or "equal to."

fractional-number notation

Given a fraction, the learner can identify its numerator and denominator.

geometry concepts

1. Given a rectangular prism, a triangular prism, a sphere, and a cylinder, the learner can identify flat or curved surfaces.
2. Given a set of plane figures, the learner can tell the number of sides and the number of corners in each figure.

measurement concepts

1. Given situations describing distance, the learner can select an appropriate measure from the metric system (centimetre or metre) and the customary system (inch, foot, yard) to quantify the distance.
2. Given objects with lengths from 0 to 10 metres and 0 to 30 feet, the learner can measure their length in centimetres and/or metres and in feet and/or yards.
3. Given a clock, the learner can tell the time to the nearest 5-minute interval.

1 +AND−

before this chapter the learner has—

1. Mastered the addition facts
2. Mastered the subtraction facts
3. Mastered finding the sum or difference of any two 2-digit numbers
4. Told the numbers of tens and the number of ones in any 2-digit number
5. Shown that the way any three 1-digit numbers are grouped for addition does not affect their sum

in chapter 1 the learner is—

1. Reviewing the addition and subtraction facts
2. Using the grouping property to simplify the addition of three 1-digit numbers
3. Reviewing adding and subtracting two 2-digit numbers
4. Using addition and subtraction to solve word problems

in later chapters the learner will—

1. Find the sum of any two 3-digit numbers
2. Find the difference of any two numbers from 0 through 999
3. Find the sum of three 2-digit numbers and show that the way these numbers are grouped does not affect their sum

Notes & Things

The amount of time spent on the addition and subtraction facts in this chapter may seem unusual. But a quick inspection of the addition computation form (algorithm) on page 18 and the subtraction algorithm on page 24 will show the reason. The two algorithms are used throughout the program. They provide a simple procedure for adding or subtracting whole numbers of any size. In order to operate independently, the child needs to know only the number facts and have some knowledge of place value.

The concepts of addition and subtraction were introduced at an earlier level. The ten-trays, fashioned from egg cartons, served as a manipulative device for each child. The action of addition was simply to bring a number of objects together with another number of objects. Filling a ten-tray also let the magic number *ten* be established in an intuitive study of place value. If there were 8 objects already in a ten-tray and there were 9 more objects to add, then the action of addition resulted in 1 full ten-tray and 7 more—or 17 objects in all. Subtraction was introduced as taking away a number of objects from the number that was already there. There was enough practice with the addition and subtraction concepts and enough drill on the number facts to expect that these facts were mastered at the end of the last level. The review in this chapter will let memories be jogged. And this is the level at which children should begin to strive for speed as well as accuracy.

You will probably be able to move quickly through this chapter. The pupils' performance on the Progress Checks will let you know who has to go more slowly.

There will be several experiences with the commutative and associative properties of addition. The names of the properties are not used. The purpose of the pages is simply to let the pupils be aware that they can manipulate the order and grouping of the numbers to be added if it makes things easier for them. It is advisable to be quite informal with commutativity at this point. Youngsters quickly assume that if you can change the order of the numbers to be added, it is also O.K. to change the order of the numbers to be subtracted. Nobody needs that problem right now.

The ten-trays will continue to be a valuable learning aid. Your pupils can probably bring one or two cartons and help make the ten-trays themselves. Any paper or plastic egg carton will do. Cut off the cover, the lip that holds the carton closed, AND two cups off one end. You don't have to worry about fancy counters. Wooden cubes or plastic counters are great if you have them, but lots of other objects work too. Pieces of construction paper or felt are especially quiet counters; cut-up plastic drinking straws, balls of aluminum foil, hard-shelled nuts, acorns, paper clips, or Styrofoam packing chips work just as well.

things

index cards
graph paper
wood cubes

For the extra activities you will want to have these things available:

- pictures of things (or actual objects) the pupils would like to buy
- play or real money—pennies, dimes, dollars
- 2 or 3 rubber jar rings

goal Think about and explore ideas through a picture clue.

page 1 Each chapter opens with a full-page photograph. Such a page contains much more than the identification of the chapter number and the chapter title. This page, for example, will give you a chance to get acquainted with your pupil's understanding of numbers through discussion questions. *There are a lot of balloons in that picture. Would it be easy to count how many? Could you count how many? If you had been in the place where this picture was taken, do you suppose there would have been a lot of other people there too? How many?*

What words do the children use? Does anyone think it's impractical to count all those balloons? That's good! What number do they think describes "a lot of people"?

Ask some questions more directly related to the chapter to come. *Suppose you and a friend really had been in that picture. Suppose each of you had bought one of those balloons. If the balloons cost 5 cents apiece, how much money would they both cost? What if the two balloons cost 10 cents each? Then how much for 2?* Continue. Try 7 cents, 15 cents, and 25 cents. Then change the situation so that there are 5 people buying balloons. Answers will probably come more slowly now. Keep your eye open for youngsters who give quick, correct answers. They may be the ones who will need a challenge every day in math.

lesson Page 2

goal **Survey**—addition and subtraction with renaming

page 2 When the children look at the addition and subtraction problems on the page, they will find some that they know how to do and some that they don't. It's tricky to give pupils problems beyond their expected achievement. They musn't feel that they are failures because they can't answer all of the questions. You can promise them that they will know how to answer all the questions in a short time. And then won't they feel smart!

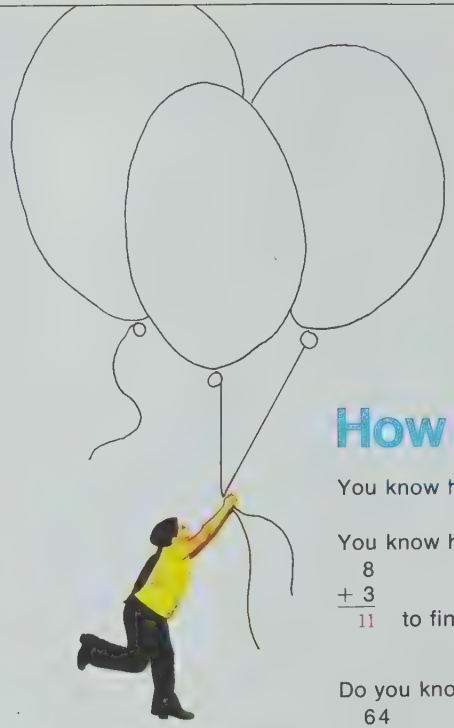
This page will help you determine who needs what. Youngsters who don't know the facts will need special help. Encourage everyone to try all the problems. If you have a group that can confidently answer all the questions, you'll know that the group will probably go through this chapter quickly.

Look for these likely errors.

```
 64          45          Reversed
+27         −29          digits.
811 (1)      24
```

Did not rename.

The chapter will provide help for correcting both types of errors.



How many?

You know how to count to find how many.

You know how to add

```
  8
+ 3
 11
```

to find how many in all.

You know how to subtract

```
 14
− 9
  5
```

to find how many remain.

Do you know how to add

```
  64
+ 27
  91
```

to find how many in all?

Don't expect every pupil to know these.

Do you know how to subtract

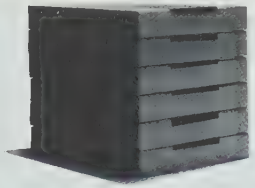
```
  45
− 29
  16
```

to find how many remain?

You will know.
That is
YOUR GOAL
You can do it!

2

Bill looked.
He saw 4 + 2 boxes.
6 in all.



Sue looked.
She saw 3 + 3 boxes.
6 in all.

Most numbers have more than one name.
4 + 2 is one name for 6. 3 + 3 is another.

1. Rename 4.

$4 = 2 + 2$
$4 = 3 + \underline{?}$ 1
Find one more name for 4.
Accept: $4 = 4 + 0$
$4 = 1 + 3$
$4 = 0 + 4$

2. Rename 5.

$5 = 2 + \underline{?}$ 3
Find two more names for 5.
Accept: $5 = 3 + 2$
$5 = 1 + 4$
$5 = 4 + 1$
$5 = 5 + 0$
$5 = 0 + 5$

3. Rename 6.

$6 = 0 + \underline{?}$ 6
$6 = 2 + \underline{?}$ 4
Find two more names for 6.
Accept: $6 = 6 + 0$
$6 = 4 + 2$
$6 = 3 + 3$
$6 = 1 + 5$
$6 = 5 + 1$

4. Rename 7.

$7 = 2 + \underline{?}$ 5
$7 = 5 + \underline{?}$ 2
Find two more names for 7.
Accept: $7 = 7 + 0$
$7 = 0 + 7$
$7 = 1 + 6$
$7 = 6 + 1$
$7 = 3 + 4$
$7 = 4 + 3$

5. Rename 8.

$8 = 4 + \underline{?}$ 4
$8 = 3 + \underline{?}$ 5
$8 = 2 + \underline{?}$ 6
Find three more names for 8.
Accept: $8 = 5 + 3$
$8 = 6 + 2$
$8 = 1 + 7$
$8 = 7 + 1$
$8 = 0 + 8$
$8 = 8 + 0$

6. Rename 9.

$9 = 7 + \underline{?}$ 2
$9 = 6 + \underline{?}$ 3
$9 = 5 + \underline{?}$ 4
Find three more names for 9.
Accept: $9 = 0 + 9$
$9 = 9 + 0$
$9 = 1 + 8$
$9 = 8 + 1$
$9 = 2 + 7$
$9 = 3 + 6$
$9 = 4 + 5$

lesson Page 3

goal Examining many names for a number

warm-up Discuss the names and nicknames people have. For example, Joe might be called Joseph, Joey, son, grandson, and so on. Debbie might be called Deborah, daughter, niece, and so on. Since this is the beginning of the year, you may want to use this idea as a get-acquainted technique by taking time to figure out who in the group has the most names. The focus of the page is on numbers that have many names.

page 3 Examine the names for 6 together. Challenge the pupils to complete the page, following these rules:

- Use only 1-digit whole numbers.
- Rename the number, using addition.

Extend the page. Find out which 1-digit number has the most names. Write the numbers from 0 through 9 across the chalkboard. Select a different pupil for each number. His job is to record all the addition names that he knows for his number. Were any names missed? This activity will give you a clue as to which pupils have had some experience with commutativity.

lesson Pages 4, 5

goal Review of the addition facts

memo It's possible the word **pattern** is new. Put 2, 4, 6, 8 on the chalkboard. Ask what number comes next. Write 6, 5, 4, 3. Ask what number comes next. A number pattern is a set of numbers organized in such a way that one can guess what number comes next.

page 4 You'll want to discuss the directions with all pupils. Urge them to align the edge of their paper with the edge of the book. They will have good straight columns when they unfold their paper. Observe their confidence in writing the answers. By the time they get halfway through the chart, they will probably discover the pattern of responses and won't even look at the addition combination. That's O.K. Each child's skills soon will be checked thoroughly.

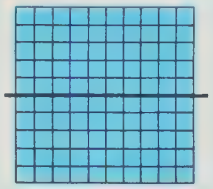
Look for patterns together. You may be surprised how many the pupils can find.

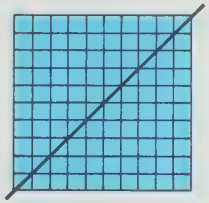
Put your paper under the first row. Add the numbers. Write the answers, or sums, on your paper. Fold your writing under. Put your paper under the second row. Write the sums on your paper. Keep going. You will have a chart of your own. Look for patterns.

	0 column	1 column	2 column	3 column	4 column	5 column	6 column	7 column	8 column	9 column
0 row	0+0 0	0+1 1	0+2 2	0+3 3	0+4 4	0+5 5	0+6 6	0+7 7	0+8 8	0+9 9
1 row	1+0 1	1+1 2	1+2 3	1+3 4	1+4 5	1+5 6	1+6 7	1+7 8	1+8 9	1+9 10
2 row	2+0 2	2+1 3	2+2 4	2+3 5	2+4 6	2+5 7	2+6 8	2+7 9	2+8 10	2+9 11
3 row	3+0 3	3+1 4	3+2 5	3+3 6	3+4 7	3+5 8	3+6 9	3+7 10	3+8 11	3+9 12
4 row	4+0 4	4+1 5	4+2 6	4+3 7	4+4 8	4+5 9	4+6 10	4+7 11	4+8 12	4+9 13
5 row	5+0 5	5+1 6	5+2 7	5+3 8	5+4 9	5+5 10	5+6 11	5+7 12	5+8 13	5+9 14
6 row	6+0 6	6+1 7	6+2 8	6+3 9	6+4 10	6+5 11	6+6 12	6+7 13	6+8 14	6+9 15
7 row	7+0 7	7+1 8	7+2 9	7+3 10	7+4 11	7+5 12	7+6 13	7+7 14	7+8 15	7+9 16
8 row	8+0 8	8+1 9	8+2 10	8+3 11	8+4 12	8+5 13	8+6 14	8+7 15	8+8 16	8+9 17
9 row	9+0 9	9+1 10	9+2 11	9+3 12	9+4 13	9+5 14	9+6 15	9+7 16	9+8 17	9+9 18

TALK ABOUT THIS PAGE

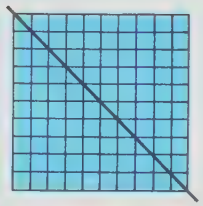
This is a tiny chart. It has the same number of □s as the number of sums you completed. It has the same number of rows and the same number of columns.





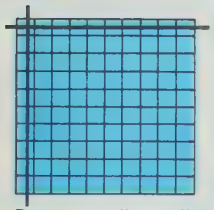
1. Draw a line like this on your chart. What do you see?

All sums are 9.



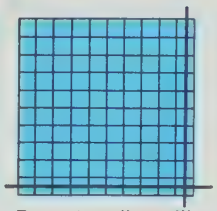
2. Draw a line like this on your chart. What do you see?

Mirror image



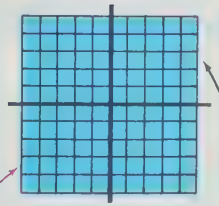
3. Draw two lines like this on your chart. What do you see?

The sums are the same and in the same order.



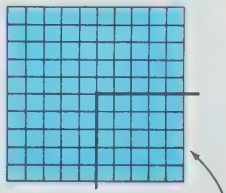
4. Draw two lines like this on your chart. What do you see?

The sums are the same and in the same order.



5. Draw two lines like this. Can you find another part that looks like this part?

Yes



6. Some people think the addition facts in this part are the hardest to remember. What do you think?

Discuss

goal Examining patterns on an addition chart

page 5 Everyone works together. *Let's see what we can discover about the addition chart.* If a youngster did not write his sums in straight columns, there will be no way that he can show the diagonals for problems 1 and 2. Let this youngster look on with someone else who had better luck in building his chart.

Extend problem 2. Ask the children to examine all the chart above the diagonal line, then all the chart below the line. *What do you see?* (Mirror reflection of the same sums) *Does anyone know why?* Find $2 + 3$, then $3 + 2$. Try similar examples.

lesson Pages 6, 7, 8

goal Practice with the addition facts

things index cards

page 6 The emphasis is on accuracy first, then speed. Make sure that everyone understands the folded-paper technique. They are to write only the sums.

Make a game of this page. *How quickly can you finish the first four rows? Try not to make any mistakes.* Have each pupil make a list (or flash cards on index cards) of the facts he missed and needs to study. The youngster who misses five or more of these easy facts needs individual help and probably needs to work with counters.

Pupils who did well should go on to rows 5, 6, and 7. Use the same techniques.

Don't copy. Put your paper under the first row. Write the sums on your paper. Fold your writing under. Put the fold under the second row. Write the sums.

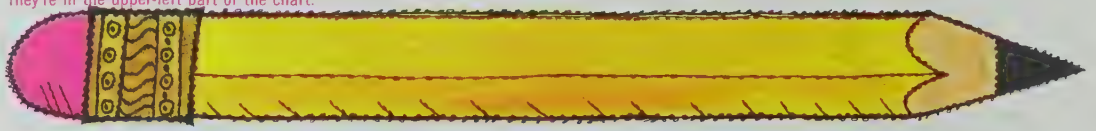
Every time you finish a row, fold your writing under.

	a	b	c	d	e	f
1.	1 + 2 = 3	3 + 3 = 6	4 + 0 = 4	2 + 1 = 3	4 + 4 = 8	0 + 1 = 1
2.	0 + 3 = 3	2 + 4 = 6	1 + 1 = 2	3 + 0 = 3	4 + 3 = 7	2 + 2 = 4
3.	4 + 1 = 5	3 + 1 = 4	0 + 2 = 2	1 + 4 = 5	3 + 4 = 7	4 + 2 = 6
4.	1 + 3 = 4	0 + 0 = 0	1 + 0 = 1	2 + 3 = 5	3 + 2 = 5	2 + 0 = 2

ADD

Look at the chart you made. Can you find these sums on your chart?

They're in the upper-left part of the chart.



NOW ADD THESE

	a	b	c	d	e	f	g	h
5.	8 + 2 = 10	6 + 2 = 8	8 + 4 = 12	9 + 1 = 10	7 + 4 = 11	5 + 3 = 8	6 + 0 = 6	7 + 2 = 9
6.	6 + 3 = 9	8 + 1 = 9	7 + 3 = 10	6 + 4 = 10	5 + 2 = 7	9 + 3 = 12	5 + 4 = 9	7 + 1 = 8
7.	8 + 0 = 8	9 + 4 = 13	5 + 1 = 6	8 + 3 = 11	9 + 2 = 11	7 + 0 = 7	6 + 1 = 7	9 + 0 = 9

Can you find these sums on your chart? Where?

In two places—the upper-right part and the lower-left part of the chart

1. Bill had 9.
Jim had 9.
How many in all? 18

2. Bill lost 7.
Jim lost 8.
How many lost in all? 15

3. Bill found 6.
Jim found 7.
How many found in all? 13

4. Jill bought 8.
Ann bought 8.
How many bought in all? 16

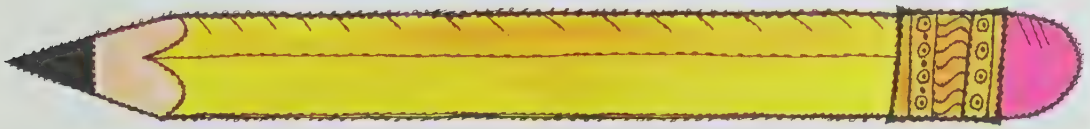
5. Jill returned 5.
Ann returned 3.
How many returned in all? 8

6. Jill used 4.
Ann used 5.
How many used in all? 9

7. He made 7.
She made 7.
How many made in all? 14

8. He made 8 more.
She made 5 more.
How many more made in all? 13

9. He sold 8.
She sold 9.
How many sold in all? 17



Some people think the next addition facts are hard.
Some people think they are easy. Put your paper under the problems. Write the sums.

	a	b	c	d	e	f	g	h
10.	7 + 4 = 11	8 + 6 = 14	9 + 5 = 14	8 + 7 = 15	6 + 9 = 15	9 + 4 = 13	6 + 8 = 14	8 + 5 = 13
11.	9 + 9 = 18	5 + 8 = 13	8 + 4 = 12	9 + 6 = 15	8 + 8 = 16	9 + 8 = 17	5 + 6 = 11	9 + 7 = 16

Do you think they are hard?

See activity 1, page 36b.

goal Review of the addition facts

page 7 Have fun with the word problems. *What did Bill and Jim have? What did Bill and Jim lose? What did they find?* The youngsters should be able to think of some great answers. You know whether or not you have to help with reading. Challenge those who can continue independently to make a small picture to tell what it could be for each problem.

When rows 10 and 11 have been completed, decide which is the easiest combination in each row and which is the hardest. Does everyone agree?

Challenge the youngsters to pick any combination from the addition chart and write a word problem. Collect their completed problems and put them in a paper bag or box. Have one volunteer draw a problem (no fair peeking), read it aloud, and solve it. Save these problems for quick practice sessions.

goal Practice with the addition facts

page 8 Use the same techniques as on page 7. Check that each pupil practices the specific facts that cause him trouble. Consider using capable students as tutors for those who need help.

Ask why certain facts are harder. On the spur of the moment, randomly select a pupil and ask for the sum of one of the facts.

Don't copy the facts.
Use the folded paper idea.
Write the sums.
Bet you can add these in a hurry.

try it

	a	b	c	d	e	f	g	h
1.	2 + 2 = 4	3 + 3 = 6	4 + 4 = 8	5 + 5 = 10	6 + 6 = 12	7 + 7 = 14	8 + 8 = 16	9 + 9 = 18
2.	9 + 0 = 9	8 + 0 = 8	7 + 0 = 7	6 + 0 = 6	5 + 0 = 5	4 + 0 = 4	3 + 0 = 3	2 + 0 = 2
3.	0 + 1 = 1	9 + 1 = 10	6 + 1 = 7	5 + 1 = 6	8 + 1 = 9	4 + 1 = 5	7 + 1 = 8	3 + 1 = 4

now add these

Watch carefully. There may not be as much work as you think.

	a	b	c	d	e	f	g	h
4.	7 + 5 = 12	5 + 7 = 12	9 + 5 = 14	5 + 9 = 14	6 + 5 = 11	5 + 6 = 11	8 + 5 = 13	5 + 8 = 13
5.	6 + 8 = 14	8 + 6 = 14	7 + 6 = 13	6 + 7 = 13	9 + 6 = 15	6 + 9 = 15	5 + 7 = 12	7 + 5 = 12
6.	7 + 9 = 16	9 + 7 = 16	7 + 8 = 15	8 + 7 = 15	8 + 9 = 17	9 + 8 = 17	0 + 9 = 9	9 + 0 = 9

Get out your chart again. Where can you find most of the sums in rows 4, 5, and 6? In the lower-right part of the chart

You know which addition facts are easy. You know which ones are hard. Make a list of the hard ones. Take some extra time. Practice them.

8

Let's find out about your skill with addition facts. Work first for the right answer, then for speed.

SET 1

	a	b	c	d	e
1.	5 + 5 = 10	4 + 5 = 9	3 + 4 = 7	2 + 3 = 5	4 + 3 = 7
2.	3 + 3 = 6	4 + 2 = 6	5 + 3 = 8	4 + 4 = 8	1 + 4 = 5
3.	5 + 2 = 7	1 + 1 = 2	0 + 4 = 4	5 + 1 = 6	2 + 5 = 7

SET 2

	a	b	c	d	e
1.	6 + 2 = 8	4 + 7 = 11	2 + 9 = 11	3 + 6 = 9	3 + 5 = 8
2.	4 + 6 = 10	2 + 7 = 9	8 + 3 = 11	5 + 9 = 14	4 + 5 = 9
3.	8 + 4 = 12	3 + 9 = 12	5 + 7 = 12	4 + 9 = 13	8 + 2 = 10

SET 3

	a	b	c	d	e
1.	9 + 4 = 13	8 + 2 = 10	9 + 3 = 12	4 + 8 = 12	5 + 4 = 9
2.	9 + 5 = 14	3 + 7 = 10	5 + 8 = 13	7 + 3 = 10	9 + 3 = 12
3.	7 + 4 = 11	8 + 3 = 11	2 + 6 = 8	3 + 8 = 11	9 + 1 = 10

SET 4

	a	b	c	d	e
1.	8 + 9 = 17	6 + 6 = 12	8 + 7 = 15	9 + 9 = 18	9 + 6 = 15
2.	7 + 7 = 14	9 + 8 = 17	8 + 6 = 14	8 + 5 = 13	7 + 8 = 15
3.	6 + 8 = 14	7 + 9 = 16	8 + 8 = 16	6 + 5 = 11	7 + 6 = 13

9

See activity 2, page 36b.

See activity 3, page 36b.

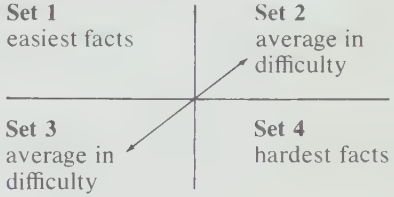
lesson Page 9

goal **Progress Check**—addition facts

memo This is the first Progress Check for the chapter. If you have a mature group, you may want to ask:

- *What does it mean to make progress?*
- *What is the purpose of checking progress in arithmetic?*
- *What should you do about the problems you get wrong?*

Problems are grouped by difficulty levels.



page 9 You may want to assign only three sets to each child: sets 1, 2, and 3 to those who are having trouble; sets 2, 3, and 4 to those who are confident.

Encourage every pupil to keep a private record of his errors. Although this appears to be a negative way of doing things, the error record is an excellent way for a child to see his specific skill weaknesses and become aware of exactly what he should practice to help assure his future success. The youngsters may go back to page 4 and investigate where each set of problems comes from.

Pupils who made more than three errors need additional help. They must show confidence at this point or they will become completely lost as they go on.

lesson Pages 10, 11, 12

goal Exploration of the concept that the way in which three addends are grouped does not affect their sum

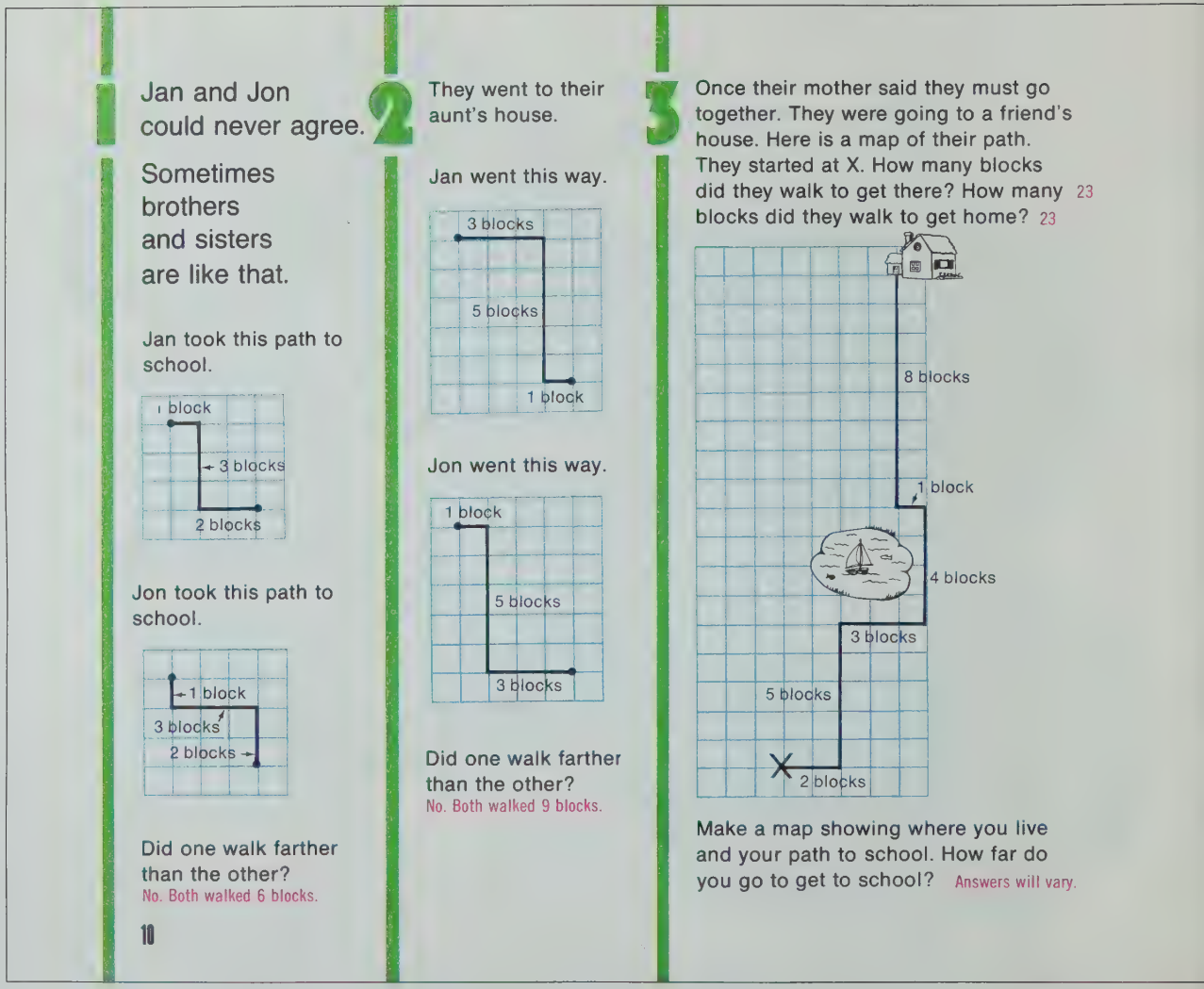
things graph paper

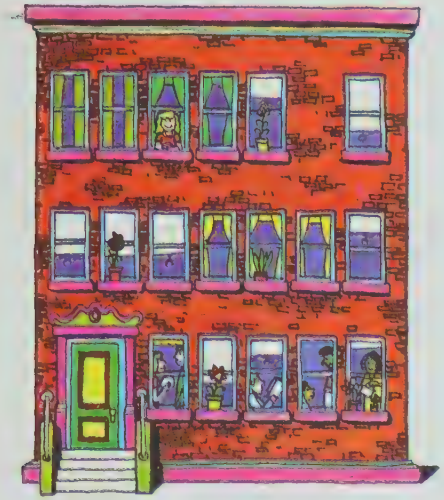
warm-up Make a street outline on the chalkboard. Ask how far it is from one street to another. Keep the discussion going until you get someone to say 1 **block.** Use colored chalk to show the blocks on your map.

Mark in the school. Mark in a familiar landmark near the school. Decide on a path to walk. Count the blocks.

page 10 Let the pupils find the answer to each question by using maps. Verify these answers on a number line.

Making a map of their path from school to home would make a good assignment. They will probably need graph paper.


Jan and Jon could never agree.
Sometimes brothers and sisters are like that.
Jan took this path to school.
1 block
3 blocks
2 blocks
Jon took this path to school.
1 block
3 blocks
2 blocks
Did one walk farther than the other?
No. Both walked 6 blocks.
10
They went to their aunt's house.
Jan went this way.
3 blocks
5 blocks
1 block
Jon went this way.
1 block
5 blocks
3 blocks
Did one walk farther than the other?
No. Both walked 9 blocks.
Once their mother said they must go together. They were going to a friend's house. Here is a map of their path. They started at X. How many blocks did they walk to get there? How many blocks did they walk to get home? 23
8 blocks
1 block
4 blocks
3 blocks
5 blocks
2 blocks
X
Make a map showing where you live and your path to school. How far do you go to get to school? Answers will vary.



Maggie lives in a three-story apartment building. She lives on the third floor.

1. How many steps?
   4 to the front door
   9 to the 2d floor
   9 to the 3d floor
   How many steps in all? 22

2. How many windows?
   5 on the 1st floor
   7 on the 2d floor
   6 on the 3d floor
   How many windows in all? 18

3. How many people?
   6 on the 1st floor
   9 on the 2d floor
   5 on the 3d floor
   How many people in all? 20

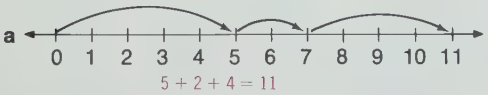
4. How many rooms?
   5 on the 1st floor
   6 on the 2d floor
   4 on the 3d floor
   How many rooms in all? 15

5. How can you add 3 numbers? Think as you add these.

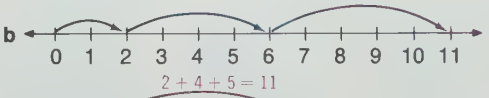
$$\begin{array}{r} 5 \\ 2 \\ +\ 4 \\ \hline ? \end{array}$$

These first?
Or these first? Does it make any difference?
No. The sum is the same.

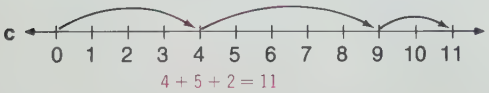
6. Write the addition sentence that is shown on each number line.

a 

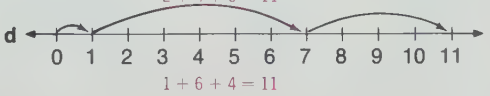
5 + 2 + 4 = 11

b 

2 + 4 + 5 = 11

c 

4 + 5 + 2 = 11

d 

1 + 6 + 4 = 11

11

See activity 4, page 36b.

goal Practice in adding three addends

page 11 You may need to help some pupils with the reading, but the problems should be completed independently.

You will want to discuss problem 5. Does everyone agree that the way three numbers are grouped does not change the answer? Can everyone prove it on a number line?

Extend problem 6 by asking if the three numbers could be grouped in another way.

goal Practice in adding three addends

things wood cubes

page 12 Using numbered cubes would allow pupils the freedom of moving the addends around to simplify grouping and would emphasize that the sum is not changed. The cubes can also be used with learners who require additional practice. Rolling the cubes will generate new problems.

Three fellows found three cubes. They got ready for a game. They taped the numeral 1 on one face of the cube, 2 on another face, 3 on another, 4 on one, 5 on one, and 6 on the last face. One fellow rolled the cubes and served as judge. The others watched the three numbers that rolled faceup. The judge decided who wrote the sum of the numbers first. See how fast you can write the sums for each turn.

Does it matter which two numbers you add first? Not to the sum, but grouping addends may make the addition easier.

The girls thought that game was too easy. They changed the numerals. They put the numerals 4 to 9 on each cube—4 on one face, 5 on another, and so on. Then they rolled the cubes and quickly wrote the sums. See how fast you can write the sums for these.

Get together with some friends. Try the game for yourself.

12

things bulletin board suggested in the activity on page 7

Have the youngsters select 3 things they would like to buy. They can change their minds—this will generate another problem.

1. 7 came in.
5 went out.
How many remain? 2

2. 9 chairs put up.
4 chairs taken down.
How many remain? 5

3. I had 8.
I lost 7.
How many remain? 1

4. 9 were in a tree.
3 flew away.
How many remain? 6

5. 11 jobs to do.
8 jobs got done.
How many remain? 3

6. 5 people came.
0 went away.
How many remain? 5

SUBTRACT

	a	b	c	d	e	f	g	h
7.	16 − 7 = 9	14 − 7 = 7	12 − 6 = 6	8 − 6 = 2	13 − 5 = 8	15 − 7 = 8	14 − 6 = 8	13 − 7 = 6
8.	12 − 4 = 8	17 − 9 = 8	11 − 7 = 4	18 − 9 = 9	10 − 3 = 7	16 − 8 = 8	11 − 4 = 7	12 − 8 = 4

Keep a record of your mistakes.
You may find you often miss the same fact.
You'll then know what to practice most.

13

lesson Pages 13, 14

goal Review of the subtraction facts

memo Mastery of basic addition and subtraction facts is absolutely essential at this level. You may want to try the following technique to create motivation.

Everyone should pick a partner. Each pair is a team, and every member must really work to get in shape. It's like a football team in training for the big game. (Select whatever sport is popular in your locale.)

Let each team construct a chart to show the progress made in training sessions. They will record errors for this page and then work to correct those errors as the training goes on. It is possible to establish a team spirit where everyone tries to help the guy who needs it most. The chart will reflect progress in subtraction.

page 13 The concept of subtraction is clear when presented in a story situation. Have fun with these word problems, but remember that they are here to review the concept of **take away.**

The subtraction combinations in rows 7 and 8 are the first big game for each team. *Is your team in shape?* Tally, then record the errors made by each player. Have the players make flash cards for the facts they missed.

goal Relating subtraction to addition

page 14 *Was your team in shape?* Rows 1 and 2 form a special exercise that might help the whole league. Have the youngsters complete the first two rows. Then try to establish the patterns if they did not find them. These patterns make excellent memory aids.

Let the team members decide if they need an extra practice session with the wheels. They have one of the biggest games coming up. Look at the next page. Abide by the decision.

Let them plan as a team what training must be done to get in shape for the next game. If a team decides that it needs a full day of extra practice, let it have the day for teamwork. Provide every learning aid available. Make use of the Resource Section, page 36a.

PATTERNS ARE FUN

They also may save you some work. Find the answers. Look for patterns.

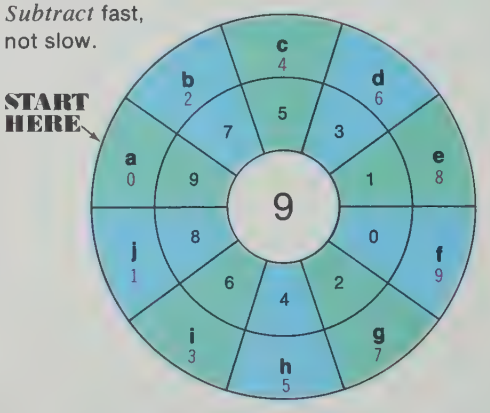
	a	b	c	d	e	f	g	h
1.	11 − 9 = 2	12 − 9 = 3	13 − 9 = 4	14 − 9 = 5	15 − 9 = 6	16 − 9 = 7	17 − 9 = 8	18 − 9 = 9

Each difference is 1 more than the ones digit of the number you subtracted from.

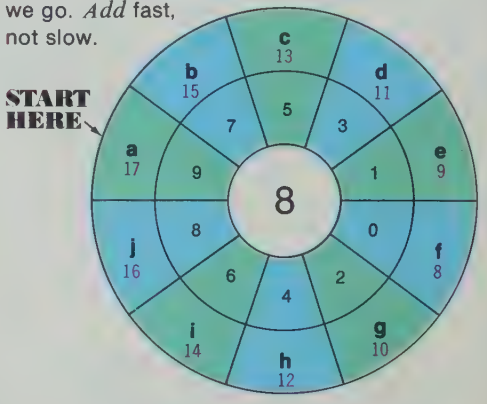
2.	2 + 9 = 11	3 + 9 = 12	4 + 9 = 13	5 + 9 = 14	6 + 9 = 15	7 + 9 = 16	8 + 9 = 17	9 + 9 = 18

The ones digit of the sum is 1 less than the number you add to 9.

3. Let the wheel go. *Subtract* fast, not slow.



4. Round and around we go. *Add* fast, not slow.



5. He had 12 pennies.
He spent 4.
How many remain? 8

6. 14 problems to do.
8 got done.
How many remain? 6

7. She bought 11.
She took back 3.
How many remain? 8

14

How good are you at subtraction? Let's check.

SET 1

	a	b	c	d	e
1.	5 − 2 = 3	8 − 4 = 4	7 − 2 = 5	9 − 3 = 6	7 − 5 = 2
2.	6 − 4 = 2	8 − 3 = 5	5 − 5 = 0	6 − 3 = 3	7 − 4 = 3
3.	8 − 5 = 3	8 − 2 = 6	9 − 4 = 5	7 − 3 = 4	0 − 0 = 0

SET 2

	a	b	c	d	e
1.	12 − 7 = 5	10 − 9 = 1	11 − 7 = 4	13 − 8 = 5	10 − 7 = 3
2.	12 − 8 = 4	11 − 8 = 3	12 − 9 = 3	11 − 9 = 2	14 − 9 = 5
3.	10 − 8 = 2	10 − 6 = 4	13 − 9 = 4	15 − 9 = 6	11 − 6 = 5

SET 3

	a	b	c	d	e
1.	11 − 2 = 9	15 − 6 = 9	13 − 5 = 8	12 − 3 = 9	13 − 4 = 9
2.	11 − 5 = 6	11 − 2 = 9	11 − 6 = 5	10 − 2 = 8	13 − 6 = 7
3.	11 − 3 = 8	12 − 5 = 7	11 − 4 = 7	14 − 5 = 9	10 − 4 = 6

SET 4

	a	b	c	d	e
1.	15 − 6 = 9	18 − 9 = 9	16 − 7 = 9	14 − 8 = 6	17 − 9 = 8
2.	15 − 8 = 7	14 − 7 = 7	16 − 9 = 7	15 − 7 = 8	12 − 5 = 7
3.	13 − 8 = 5	17 − 8 = 9	13 − 7 = 6	16 − 8 = 8	14 − 6 = 8

15

See activity 5, page 36c.

See activity 6, page 36c.

lesson Pages 15, 16

goal **Progress Check** – subtraction facts

page 15 The big game – more commonly known as a progress check. Although team scores will be recorded, let the pupils play independently. Note that each set becomes increasingly more difficult.

easy	difference <6
difference >6	hard mixed

Bring the team record up to date. Members who made more than three errors need more practice. Mastery is the goal. Page 16 will provide some help.

goal Additional practice with addition and subtraction facts

page 16 Use rows 1, 2, 3, and 4 only with youngsters who are having trouble. Discuss the three examples. *Do you think this will always work? Prove it with rows 1, 2, 3, and 4.* Use the folded-paper technique and have them record answers only.

Provide additional practice activities for those who are still having trouble. Try flash cards and a partner. Use any other drill materials or games you have available. Remember the Resource Section.

Use rows 5 and 6 as a team game. Record results on the team charts.

Having trouble with subtraction? Let addition help.

15 − 8 = ? THINK

What number plus 8 equals 15?

13 − 7 = ?	THINK	■ + 7 = 13, ■ = 6
14 − 5 = ?	THINK	■ + 5 = 14, ■ = 9
14 − 6 = ?	THINK	■ + 6 = 14, ■ = 8

Subtract. If you have trouble, think addition.

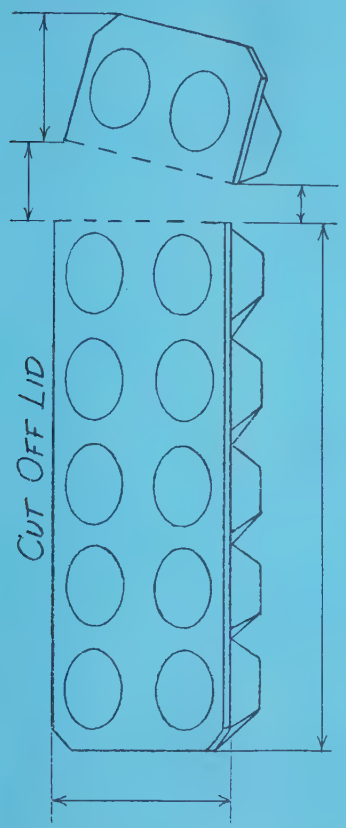
	a	b	c	d	e	f
1.	10 − 8 = 2	12 − 4 = 8	15 − 6 = 9	17 − 8 = 9	14 − 8 = 6	13 − 6 = 7
2.	11 − 7 = 4	13 − 4 = 9	9 − 5 = 4	7 − 6 = 1	6 − 2 = 4	2 − 2 = 0
3.	8 − 7 = 1	6 − 5 = 1	5 − 3 = 2	5 − 4 = 1	11 − 8 = 3	13 − 9 = 4
4.	10 − 6 = 4	12 − 5 = 7	11 − 3 = 8	10 − 7 = 3	12 − 9 = 3	10 − 5 = 5

Do these.
Look at the sign.

WATCH OUT!

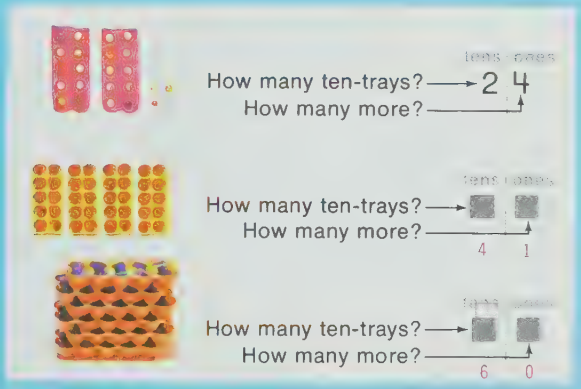
	a	b	c	d	e	f	g	h
5.	9 + 4 = 13	12 − 7 = 5	7 + 3 = 10	14 − 5 = 9	5 + 9 = 14	15 − 8 = 7	6 + 3 = 9	16 − 7 = 9
6.	8 + 3 = 11	4 + 9 = 13	15 − 7 = 8	14 − 9 = 5	10 − 3 = 7	4 + 7 = 11	11 − 9 = 2	4 + 8 = 12

16



THIS IS A TEN-TRAY

YOU CAN MAKE IT BY GETTING AN EGG CARTON (WITHOUT EGGS IN IT). CUT OFF THE LID. CUT OFF TWO OF THE CUPS AT ONE END. THIS TEN-TRAY HOLDS TEN COUNTERS. THE COUNTERS CAN BE ANYTHING THAT WILL FIT. THE TEN-TRAY CAN HELP YOU UNDERSTAND HOW NUMBERS OPERATE.



1. If you had 90 counters, how many ten-trays could you fill? 9
2. If you had 10 counters, how many ten-trays could you fill? 1
3. If you had 9 counters, how many ten-trays could you fill? 0
4. If you had 19 counters, how many ten-trays could you fill? 1
5. If you had 100 counters, how many ten-trays could you fill? 10

17

lesson Pages 17, 18, 19

goal Review of place value for 2-digit numbers

memo Understanding place value is a prerequisite for understanding addition and subtraction with renaming. Ten-trays are used to provide the necessary manipulative experiences with groups of ten.

Learners who have used this program will be familiar with ten-trays. For the others this may be a new approach.

things ten-trays
counters

warm-up Provide each pupil with more than 10 but less than 20 counters and 1 ten-tray. *How many counters do you have?* Then have the pupils put 1 counter in each cup of their tray. *How many are in the tray? How many ones are not in the tray? How many counters do you have in all?*

Form several groups of children. *How many loose ones does the group have? How many tens?* Distribute more trays. *Can you fill another tray? Now how many loose ones are there? How many tens? How many counters do you have in all?*

page 17 Since it is the entry into place value, this page is important for each child. The form of notation presented here will be used to develop both the addition and subtraction algorithms.

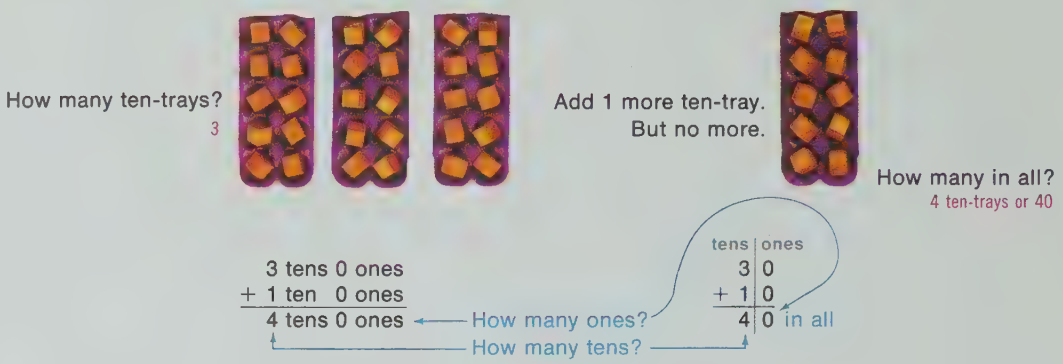
goal Exploration and practice in adding two 2-digit multiples of 10

memo The example dramatically shows the potential trouble that expanded notation can create. The expanded form allows the child to compute tens first, then ones. The algorithm demands that the ones be added first or there will be a readiness when renaming is involved. Even though this page is limited to multiples of 10, please ask how many ones and **then ask** how many tens. The thought pattern can then be introduced early enough so that there will be no problem later.

things ten-trays
counters

page 18 Use ten-trays and counters to examine the example problem. Work through the computation steps (algorithm).

Observe the youngsters as they complete the first row of problems. Watch for those who still need more manipulative experience. Work with these children, using full ten-trays, until they feel confident enough to go on independently.



	a	b	c	d	e	f	g
1.	tens | ones 1 | 0 + 1 | 0 2 | 0	tens | ones 2 | 0 + 1 | 0 3 | 0	tens | ones 3 | 0 + 2 | 0 5 | 0	tens | ones 4 | 0 + 1 | 0 5 | 0	tens | ones 3 | 0 + 3 | 0 6 | 0	tens | ones 8 | 0 + 1 | 0 9 | 0	tens | ones 1 | 0 + 3 | 0 4 | 0
2.	tens | ones 4 | 0 + 2 | 0 6 | 0	tens | ones 4 | 0 + 3 | 0 7 | 0	tens | ones 5 | 0 + 1 | 0 6 | 0	tens | ones 6 | 0 + 2 | 0 8 | 0	tens | ones 7 | 0 + 1 | 0 8 | 0	tens | ones 2 | 0 + 4 | 0 6 | 0	tens | ones 3 | 0 + 2 | 0 5 | 0
3.	tens | ones 7 | 0 + 2 | 0 9 | 0	tens | ones 5 | 0 + 3 | 0 8 | 0	tens | ones 6 | 0 + 1 | 0 7 | 0	tens | ones 4 | 0 + 4 | 0 8 | 0	tens | ones 2 | 0 + 2 | 0 4 | 0	tens | ones 5 | 0 + 2 | 0 7 | 0	tens | ones 3 | 0 + 6 | 0 9 | 0

18

2 candy bars for 10 cents each. How many tens? 2
5 pencils for 10 cents each. How many tens? 5
How many cents in all? How many tens in all? 7
70

tens	ones	
2	0	
+ 5	0	
7	0	cents

1. 2 boys, 10 fingers each.
2 girls, 10 fingers each.
How many fingers in all? 40

2. 3 boxes, 10 pencils in each.
5 boxes, 10 pencils in each.
How many pencils in all? 80

3. 3 red ballons, 10 cents each.
3 blue balloons, 10 cents each.
How many cents in all? 60

4. 3 boxes, 10 pounds each.
6 bags, 10 pounds each.
How many pounds in all? 90

5. You have 20.
I have 30.
He has 10.
How many in all?

tens	ones
2	0
3	0
+ 1	0
6 ■	■ 0

6. He has 10.
You have 20.
I have 30.
How many in all?

tens	ones
1	0
2	0
+ 3	0
6 ■	■ 0

7. Look at the numbers you added in the last two problems. Are they the same? Are they in the same order? No
Are the answers the same? Yes Yes

	a	**b**	**c**	**d**	**e**	**f**	**g**
8.	3 0 3 0 + 1 0 7 0	1 0 3 0 + 4 0 8 0	7 0 1 0 + 1 0 9 0	5 0 2 0 + 1 0 8 0	1 0 5 0 + 2 0 8 0	6 0 1 0 + 1 0 8 0	3 0 4 0 + 2 0 9 0
9.	2 0 4 0 + 3 0 9 0	6 0 2 0 + 1 0 9 0	5 0 3 0 + 1 0 9 0	4 0 2 0 + 1 0 7 0	3 0 1 0 + 3 0 7 0	4 0 1 0 + 2 0 7 0	2 0 3 0 + 4 0 9 0

19

goal Practice in adding three 2-digit multiples of 10

memo Please continue to ask how many ones and then how many tens.

page 19 You decide how best to handle the word problems. Keep those numbers in straight columns. Turning lined paper sideways helps.

Make sure that you discuss problem 7. No need to mention the associative property unless you want to. Having the pupil use this order property to simplify his computation is more important than memorizing technical words.

Challenge the youngsters to be detectives. *Look at rows 8 and 9. Find a pair of problems that have the same numbers but in different order.* (**8a** and **9e, 8d** and **e, 8g** and **9a**) *Will the answers be the same for both problems in the pair?*

After pupils complete rows 8 and 9, challenge them to find two problems that have the same sum but do not have the same numbers.

lesson Page 20

goal Exploration and practice in adding two 2-digit numbers, no renaming

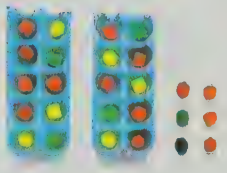
things ten-trays
counters

warm-up Display 2 full ten-trays and 6 counters. Let someone record on the chalkboard what they see. Put out another full ten-tray. Have this action recorded. *How many in all?*

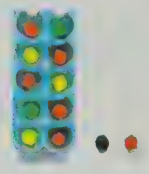
Go back to just 2 full trays and 6 counters. Record. This time add 1 full tray and 3 more. Record again. *Now how many in all?*

page 20 Discuss the examples together. Emphasize adding ones first, then adding tens. Those who are confident can complete the page independently. Encourage the use of manipulatives for those who are not secure.

How many ten-trays? 2
How many more? 6



Now *add* 1 ten-tray.
And two more.



How many ones? 8
How many tens? 3
How many in all? 38

Start here

2 tens 6
+ 1 ten 2
? tens ?

How many ones?
How many tens?

tens	ones
2	6
+ 1	2
3	8 in all

Get ready to add.

1.

tens	ones
4	4
+ 2	3
6	7

← First write how many ones.
Then write how many tens.
Now you know how many in all.

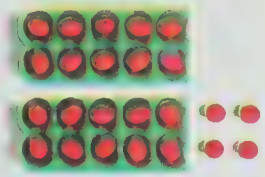
	a	b	c	d	e	f	g
2.	63 + 32 = 95	37 + 10 = 47	25 + 24 = 49	32 + 25 = 57	76 + 10 = 86	52 + 17 = 69	27 + 31 = 58
3.	59 + 20 = 79	33 + 56 = 89	25 + 50 = 75	11 + 88 = 99	38 + 30 = 68	33 + 45 = 78	81 + 16 = 97

20

Be a number detective. Find the missing number.

1 □	7 2	1 □ 2	□ 5
+ 3 1	+ □ 7	+ □ 3 □	+ 1 □
□ 9	9 □	3 7 5	8 7

How many ten-trays? 2
How many more? 4



Here's 2 tens 4.

Now *add* 18 more.

Add 1 ten 8.
Are there 3 tens and 12 more?' Yes
Are you sure? Yes
Think about the 12. Could you take 10 of them and fill a tray? Yes
Now how many ones? How many tens? 2 ones, 4 tens
How many in all? 42

THAT IS WHAT YOU THINK

2 tens 4
+ 1 ten 8
3 tens 12 — How many tens and ones in 12?
How many tens?
How many in all?

THIS IS WHAT YOU WRITE

tens	ones
2	4
+ 1	8
1	2
3	
4	2

t	o
4	6
+ 2	9
1	5
6	
7	5

Write **t** for ten and **o** for ones.

6 + 9 = 15 How many tens and ones in 15?
Make sure the 1 ten is in the right place.
Now think. I started with 4 tens + 2 tens.
That's 6 tens. Write it in the tens place.
You've just about finished. Write how many in all.

Try these problems.

	t	o
1.	3	6
	+ 2	9
	1	5
	5	
	6	5

	t	o
2.	4	8
	+ 3	4
	1	2
	7	
	8	2

	t	o
3.	3	9
	+ 1	4
	1	3
	4	
	5	3

21

lesson Pages 21, 22, 23

goal Examining the addition of two 2-digit numbers with renaming

memo This is a review of work covered in level 2, but there are a lot of ideas on this extremely important page. You will want to make certain that everyone gets off to a sure start.

things ten-trays
counters

warm-up Display 2 full ten-trays and 6 counters. Record how many on the chalkboard. Display 1 full tray and 8 counters more. Have the youngsters record what they see and add to tell how many in all. Most of them will write 3 tens 14. *What could we do with these 14?* Prod until someone thinks of putting 10 of the 14 into an empty tray. *Now how many ones? How many full ten-trays? How many in all?*

page 21 This is really a study-guide page. The questions are all on the page, but the pupils will need your voice interpretation. Lead until you reach problems 1 through 3. Then split the class into groups. Supply each group with ten-trays and counters to use with problems 1 through 3. The manipulative experience is important to jog memories of the algorithm and to remind each pupil of the renaming of ones.

goal Practice in adding two 2-digit numbers with renaming

things ten-trays
counters

page 22 Review how to record the action of the addition. Have the groups complete the page, simulating the problems with manipulatives when necessary.

He had 2 boxes of 10 and 6 more.
She had 3 boxes of 10 and 7 more.
How many did they have in all?

	t	o
2 tens	2	6
+ 3 tens	+ 3	7
5 tens 13	5	13

How many tens and ones in 13? → 1 3
How many tens? → 5
How many in all? → 6 3

ADD

Don't forget!
First add the ones.
Then add the tens.
Write how many in all.

1.	t	o	**2.**	t	o	**3.**	t	o	**4.**	t	o	**5.**	t	o
	2	8		3	5		6	4		4	2		2	5
	+ 1	3		+ 1	8		+ 1	9		+ 2	4		+ 2	9
	1	1		1	3		1	3			6		1	4
	3			4			7			5			4	
	4	1		5	3		8	3		6	6		5	4

6.	t	o	**7.**	t	o	**8.**	t	o	**9.**	t	o	**10.**	t	o
	5	3		3	7		1	9		2	7		5	4
	+ 2	9		+ 4	5		+ 3	5		+ 1	8		+ 3	6
	1	2		1	2		1	4		1	5		1	0
	7			7			4			3			8	
	8	2		8	2		5	4		4	5		9	0

11.	t	o	
	6	9	
	+ 2	1	
	1	0	
	8		
	9	0	

22

things for each pair: lined paper, cube numbered 0 through 5, cube numbered 4 through 9, counters of 2 colors

Turn lined paper sideways. Number the columns from 1 through 18. Each pupil uses counters of one color. The first player rolls the two cubes and adds the numbers that land faceup. If the opponent agrees that the sum is correct, the player places a counter under the appropriate numeral. The turn passes to the second player. The one with the most counters under the cards wins. *Which answer came up most often?*

	t	o
4 tens	4	6
+ 2 tens	+ 2	5
6 tens 11 →	1	1
	6	
	7	1

First add the ones.
Then add the tens.
Write how many in all.

Practice some more addition.

	t	o		t	o		t	o		t	o
1.	2	9	2.	2	6	3.	4	7	4.	1	6
	+ 4	2		+ 3	4		+ 3	7		+ 4	6
	1	1		1	0		1	4		1	2
	6			5			7			5	
	7	1		6	0		8	4		6	2

	t	o		t	o		t	o		t	o
5.	7	9	6.	2	4	7.	4	6	8.	1	7
	+ 1	8		+ 3	7		+ 1	7		+ 3	9
	1	7		1	1		1	3		1	6
	8			5			5			4	
	9	7		6	1		6	3		5	6

	t	o		t	o		t	o		t	o
9.	2	6	10.	1	3	11.	6	8	12.	3	9
	+ 5	5		+ 2	8		+ 1	2		+ 5	2
	1	1		1	1		1	0		1	1
	7			3			7			8	
	8	1		4	1		8	0		9	1

Don't get fooled on these.
Be prepared for
something new.

	t	o		t	o
13.	7	4	14.	6	8
	+ 2	6		+ 3	2
	1	0		1	0
	9			9	
	10	0		10	0

	t	o		t	o
15.	4	5	16.	5	9
	+ 4	5		+ 4	1
	1	0		1	0
	8			9	
	9	0		23	
				10	0

See activity 7, page 36c.

See activity 8, page 36c.

goal **Progress Check**—adding two 2-digit numbers with renaming

memo Treat this as a practice page. Use it to identify those pupils who can operate with confidence and those who need additional practice with manipulatives before going on to subtraction with renaming.

page 23 You may want to review the example together. Use ten-trays and counters if you feel these are necessary. Have pupils complete only problems 1 through 12 independently.

Watch out! Problems 13 through 16 present a challenge. Use ten-trays if necessary. Ten-trays neatly show the ten formed when the ones are added. Be sure to talk about these problems.

lesson Pages 24, 25, 26

goal Exploration and practice in subtracting two 2-digit multiples of 10

memo Each page of this lesson moves up a level in the sequence of development for subtraction with renaming. Make certain that the pupil feels confident at the first level before moving him on to page 25 and farther. Let anyone who lacks confidence continue to use manipulatives. Provide him with additional practice.

things ten-trays
counters

page 24 Notice that the problems are limited to multiples of 10. You will still begin by asking how many ones. *Can anyone show subtraction with the ten-trays?* Examine the model at the top of the page. *Are there any loose ones? How many ten-trays?* Subtract 1 ten-tray. *Any loose ones now? How many ten-trays remain?*

Watch the youngsters as they complete the first row. Some may need additional practice manipulating ten-trays before they feel secure enough to work independently.

What Happens in Subtraction?

How many ten-trays? 3

Subtract 1 ten-tray.
But no more. How many remain? 2 ten-trays

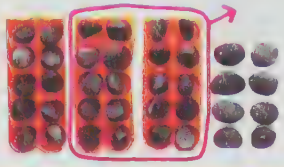
What we had to start with → 3 tens 0 ones → t o: 3 0
What was taken away → − 1 ten 0 ones → − 1 0
How many remain? → 2 tens 0 ones → 2 0

Subtract.

	a	b	c	d	e	f
1.	50 − 20 = 30	40 − 10 = 30	40 − 20 = 20	70 − 50 = 20	20 − 10 = 10	90 − 10 = 80
2.	30 − 20 = 10	80 − 70 = 10	60 − 30 = 30	50 − 40 = 10	40 − 30 = 10	70 − 30 = 40
3.	70 − 40 = 30	90 − 50 = 40	40 − 40 = 0	80 − 30 = 50	60 − 40 = 20	50 − 30 = 20
4.	90 − 20 = 70	80 − 60 = 20	70 − 10 = 60	80 − 50 = 30	90 − 60 = 30	60 − 40 = 20

24

Think Subtraction



How many ten-trays? 3
How many loose ones? 8

Take 2 ten-trays away. But no loose ones.
How many loose ones now? 8
How many ten-trays now? 1
In all, how many remain? 18

What we had to start with → 3 tens 8 → 3 8
What was taken away → − 2 tens 0 → − 2 0
How many remain? → 1 ten 8 → 1 8

Subtract.

	a	b	c	d	e	f
1.	45 − 10 = 35	39 − 20 = 19	71 − 40 = 31	56 − 30 = 26	98 − 10 = 88	63 − 30 = 33
2.	56 − 20 = 36	43 − 10 = 33	62 − 50 = 12	94 − 70 = 24	47 − 30 = 17	89 − 60 = 29
3.	38 − 10 = 28	67 − 50 = 17	75 − 10 = 65	41 − 20 = 21	62 − 20 = 42	51 − 30 = 21
4.	82 − 70 = 12	61 − 40 = 21	93 − 30 = 63	75 − 60 = 15	91 − 50 = 41	79 − 50 = 29

goal Exploration and practice in subtracting a multiple of 10 from a 2-digit number

things ten-trays
counters

page 25 Work the example shown with ten-trays and counters. Discuss how to record the action. Ask if anyone can tell how this problem is different from the ones they have been doing. **Praise** those who can tell.

Observe pupils closely as they complete row 1. Get out the ten-trays for anyone who needs them. The remaining rows are independent work.

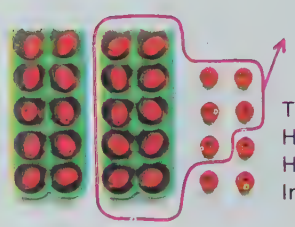
goal **Progress Check**—subtracting two 2-digit numbers, no renaming

page 26 Ten-trays and counters for everyone. If you haven't enough, group pupils in small groups. This page focuses on an important prerequisite before going on to renaming. Work several examples with manipulatives. Stress the recording. Emphasize subtracting ones first, then tens. Has anyone spotted how these problems are different?

Again, closely observe pupils as they complete the first row. Encourage the use of ten-trays and counters for those who are obviously insecure. You may not want to do all the problems on one day.

Any pupil who is having trouble must have more practice before moving on to subtraction with renaming.

Keep thinking subtraction.
How many ten-trays? 2
How many loose ones? 8



Take away 1 ten-tray *and* 5 loose ones.
How many ones now? 3
How many tens now? 1
In all, how many remain? 13

		t	o
What we had to start with →	2 tens 8 →	2	8
What was taken away →	− 1 ten 5 →	− 1	5
How many remain? →	1 ten 3 →	1	3

Subtract.

	a	b	c	d	e	f	g
1.	t o 3 9 − 1 7 2 2	t o 5 9 − 1 4 4 5	t o 2 8 − 1 1 1 7	t o 3 7 − 2 2 1 5	t o 3 7 − 1 3 2 4	t o 2 5 − 1 4 1 1	t o 3 6 − 1 5 2 1
2.	t o 4 7 − 2 6 2 1	t o 5 9 − 3 8 2 1	t o 9 3 − 2 0 7 3	t o 4 5 − 1 5 3 0	t o 5 8 − 2 2 3 6	t o 3 9 − 2 3 1 6	t o 6 4 − 4 1 2 3
3.	t o 8 9 − 4 0 4 9	t o 3 7 − 1 6 2 1	t o 2 3 − 1 3 1 0	t o 4 9 − 3 7 1 2	t o 5 2 − 4 0 1 2	t o 9 6 − 4 1 5 5	t o 7 6 − 3 4 4 2

26

Number detectives can subtract too.
Find the missing number.

3 □ − □ 5 1 4	7 7 − 2 □ □ 5	5 □ 6 − □ 3 □ 4 5 4	8 □ − □ 4 4 4

See activity 9, page 36c.

Bill went to the cookie jar.
He wanted to take 3 cookies.
There were no cookies there.
Could he take 3 cookies from the jar? No

There was 1 package of 10 thumbtacks.
There were no loose ones anywhere.
Marie needs 3 tacks.
What could she do to get 3? Open the package and remove 3 thumbtacks.

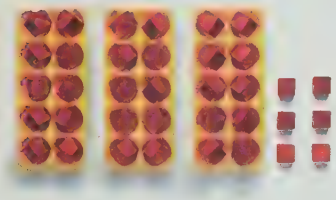
There was 1 package of 10 pencils.
There were 2 more pencils beside the package.
8 people needed 1 pencil each.
How could they get the 8 pencils?
Give out the 2 pencils, open the package, and give out 6 pencils to the remaining 6 people.

The same sort of thing can happen when we subtract numbers.

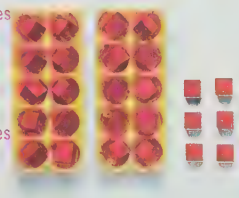
	tens	ones	
	3	6	to start with
−		9	to be taken away
		NO	

Use ten-trays to help you think this one through.

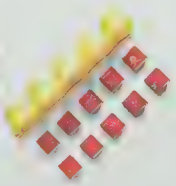
How can you take 9 away?



Can you dump one ten-tray? Yes



Now you have 16 loose ones.
Can you take 9 away? Yes
How many remain?
2 ten-trays and 7 loose ones



27

lesson Pages 27, 28, 29

goal Examining subtraction requiring renaming

things ten-trays
counters

page 27 This is the beginning of the development of a difficult concept. This is a time to share and to guide thinking. Listen to the pupils' reasoning as the problem situation is explored. Does anyone have another idea? Their responses will be indicators of problem-solving ability.

Have ten-trays ready to use to enact the example. Challenge them for a solution. The notion of dumping a ten-tray is a reasonable solution for most children. They will enjoy the action. Go directly to page 28.

goal Examining the algorithm for subtraction requiring renaming

memo This algorithm was introduced in level 2. It is possible that the pupils have forgotten nearly everything. Please don't make any assumptions. It's better to go slowly now and speed up later during the practice pages.

things ten-trays
counters

page 28 With pupils who aren't ready to record, do several more examples with manipulatives only. Move into the recording step when the action is understood. Nice and easy. Stress subtracting ones first.

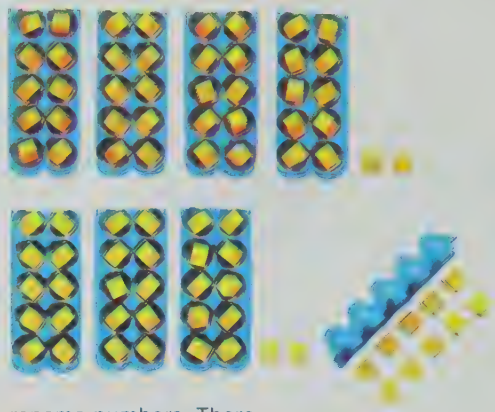
Watch for youngsters who make this common error:

$$\begin{array}{r} 53 \\ -\ 7 \\ \hline 54 \end{array}$$

The false idea of always being able to subtract the smallest number from the largest number should be caught now.

They need more experience with ten-trays and counters.

TRY ANOTHER PROBLEM



Your job is to take 8 away.

Look at the numbers after you dump one ten-tray.

$$\begin{array}{r} 3\ 12 \\ \not{4}\not{2} \\ -\ \ 8 \\ \hline 3\ 4 \end{array}$$

another name for 42
to start with
to take away
remain

It's a good thing we can rename numbers. There would be real trouble with subtraction if we couldn't.

This is what you might think as you get ready to subtract.

$$\begin{array}{r} 5\ 3 \\ -\ \ 7 \\ \hline \text{NO} \end{array}$$

to start with
to take away
You need to rename 53.

$$\begin{array}{r} 4\ 13 \\ \not{5}\not{3} \\ -\ \ 7 \\ \hline \blacksquare\ \blacksquare \\ 4\ 6 \end{array}$$

Now you can subtract!

Time for practice. You will have to rename tens and ones each time.

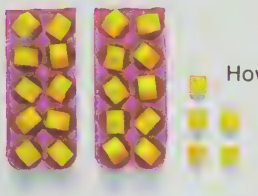
1. $\begin{array}{r} 3\ 15 \\ \not{4}\not{5} \\ -\ \ 6 \\ \hline \blacksquare\ \blacksquare \\ 3\ 9 \end{array}$ ← First rename. ← Then subtract. ← How many ones remain? ← How many tens remain?

2. $\begin{array}{r} 2\ 12 \\ \not{3}\not{2} \\ -\ \ 6 \\ \hline 2\ 6 \end{array}$

3. $\begin{array}{r} 5\ 14 \\ \not{6}\not{4} \\ -\ \ 7 \\ \hline 5\ 7 \end{array}$

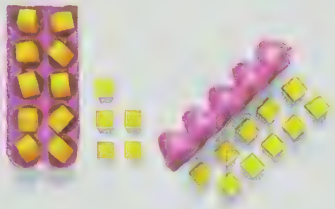
You'll get good at this in no time at all.

28



How many in all? 25
Take away 8.

$$\begin{array}{r} 2\,5 \\ -\ 8 \\ \hline \end{array}$$ NO



How many in all?
Take away 8.
1 ten, 15 ones (or 25)

$$\begin{array}{r} {}^{1}\not{2}\,{}^{15}\not{5} \\ -\ 8 \\ \hline \blacksquare\ \blacksquare \leftarrow \text{ones remain} \\ \blacksquare \leftarrow \text{tens remain} \\ 1\ 7 \end{array}$$

First rename.
Then subtract.

Rename and subtract.

	a	b	c	d	e	f	g
1.	$\begin{array}{r} {}^{4}\not{5}\,{}^{14}\not{4} \\ -\ 6 \\ \hline 4\ 8 \end{array}$	$\begin{array}{r} {}^{1}\not{2}\,{}^{16}\not{6} \\ -\ 8 \\ \hline 1\ 8 \end{array}$	$\begin{array}{r} {}^{2}\not{3}\,{}^{16}\not{6} \\ -\ 7 \\ \hline 2\ 9 \end{array}$	$\begin{array}{r} {}^{3}\not{4}\,{}^{11}\not{1} \\ -\ 6 \\ \hline 3\ 5 \end{array}$	$\begin{array}{r} {}^{5}\not{6}\,{}^{14}\not{4} \\ -\ 7 \\ \hline 5\ 7 \end{array}$	$\begin{array}{r} {}^{5}\not{6}\,{}^{13}\not{3} \\ -\ 9 \\ \hline 5\ 4 \end{array}$	$\begin{array}{r} {}^{5}\not{6}\,{}^{14}\not{4} \\ -\ 5 \\ \hline 5\ 9 \end{array}$
2.	$\begin{array}{r} {}^{2}\not{3}\,{}^{15}\not{5} \\ -\ 8 \\ \hline 2\ 7 \end{array}$	$\begin{array}{r} {}^{2}\not{3}\,{}^{12}\not{2} \\ -\ 4 \\ \hline 2\ 8 \end{array}$	$\begin{array}{r} {}^{6}\not{7}\,{}^{11}\not{1} \\ -\ 5 \\ \hline 6\ 6 \end{array}$	$\begin{array}{r} {}^{3}\not{4}\,{}^{17}\not{7} \\ -\ 9 \\ \hline 3\ 8 \end{array}$	$\begin{array}{r} {}^{2}\not{3}\,{}^{10}\not{0} \\ -\ 1 \\ \hline 2\ 9 \end{array}$	$\begin{array}{r} {}^{4}\not{5}\,{}^{11}\not{1} \\ -\ 2 \\ \hline 4\ 9 \end{array}$	$\begin{array}{r} {}^{5}\not{6}\,{}^{12}\not{2} \\ -\ 3 \\ \hline 5\ 9 \end{array}$
3.	$\begin{array}{r} {}^{3}\not{4}\,{}^{10}\not{0} \\ -\ 9 \\ \hline 3\ 1 \end{array}$	$\begin{array}{r} {}^{6}\not{7}\,{}^{13}\not{3} \\ -\ 4 \\ \hline 6\ 9 \end{array}$	$\begin{array}{r} {}^{1}\not{2}\,{}^{12}\not{2} \\ -\ 8 \\ \hline 1\ 4 \end{array}$	$\begin{array}{r} {}^{4}\not{5}\,{}^{10}\not{0} \\ -\ 2 \\ \hline 4\ 8 \end{array}$	$\begin{array}{r} {}^{3}\not{4}\,{}^{16}\not{6} \\ -\ 9 \\ \hline 3\ 7 \end{array}$	$\begin{array}{r} {}^{1}\not{2}\,{}^{13}\not{3} \\ -\ 4 \\ \hline 1\ 9 \end{array}$	$\begin{array}{r} {}^{1}\not{2}\,{}^{18}\not{8} \\ -\ 9 \\ \hline 1\ 9 \end{array}$

29

goal Practice with subtraction requiring renaming

memo Please encourage the pupils to rename both the tens and the ones **before** they find out how many ones remain. This will save a lot of careless errors.

things ten-trays
counters

page 29 Use manipulatives to review the action of subtracting and the recording steps. Observe the youngsters closely as they complete the first row. Let those who are confident continue independently while you work with those who are unsure. Focus on the action first, then on the recording steps. You may not want to assign all the problems at one time.

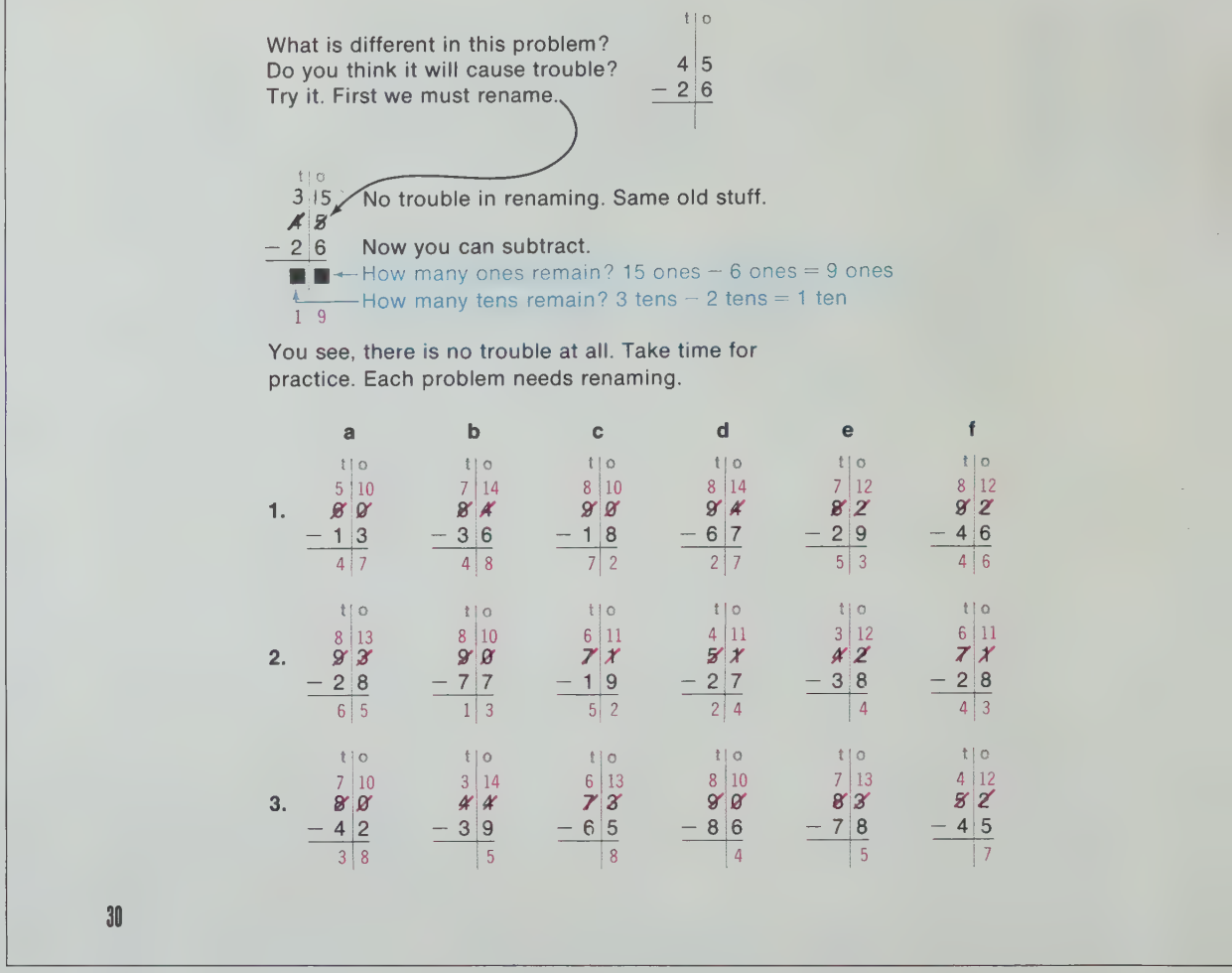
lesson Pages 30, 31, 32

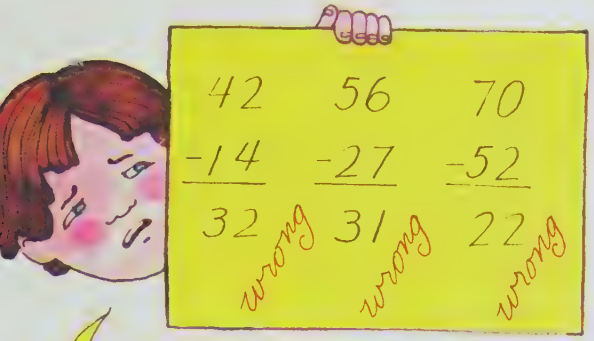
goal Exploration and practice in subtracting two 2-digit numbers requiring renaming

memo This doesn't look like much of a step, but it can be a big one for some pupils. Renaming to be able to subtract ones should not be hard. But now the pupil has to remember to subtract some tens also. Wow! Be prepared to pull out the ten-trays again.

page 30 The example provides a thinking guide. *Does anyone notice something different?*

Use ten-trays and counters if necessary. Check carefully as the pupils complete the first row. **Now** is the time to help those who are insecure.


What is different in this problem?
Do you think it will cause trouble?
Try it. First we must rename.
t o
4 5
− 2 6
t o
3 15
No trouble in renaming. Same old stuff.
− 2 6
Now you can subtract.
How many ones remain? 15 ones − 6 ones = 9 ones
How many tens remain? 3 tens − 2 tens = 1 ten
1 9
You see, there is no trouble at all. Take time for practice. Each problem needs renaming.
a b c d e f
1. 5 10 | 7 14 | 8 10 | 8 14 | 7 12 | 8 12
− 1 3 | − 3 6 | − 1 8 | − 6 7 | − 2 9 | − 4 6
4 7 | 4 8 | 7 2 | 2 7 | 5 3 | 4 6
2. 8 13 | 8 10 | 6 11 | 4 11 | 3 12 | 6 11
− 2 8 | − 7 7 | − 1 9 | − 2 7 | − 3 8 | − 2 8
6 5 | 1 3 | 5 2 | 2 4 | 4 | 4 3
3. 7 10 | 3 14 | 6 13 | 8 10 | 7 13 | 4 12
− 4 2 | − 3 9 | − 6 5 | − 8 6 | − 7 8 | − 4 5
3 8 | 5 | 8 | 4 | 5 | 7
30



Talk about this page.

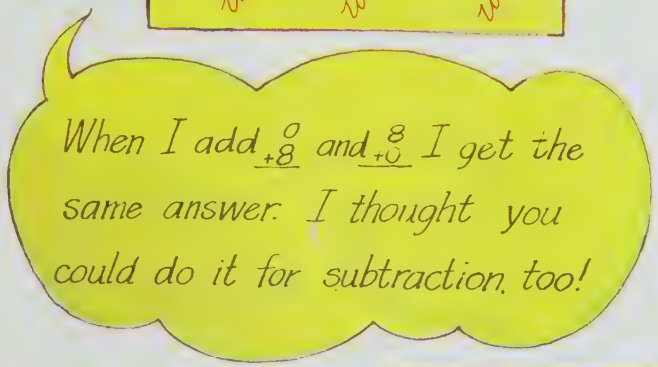
He is not happy.
And here is why.
Just look at
his paper.

What did he do wrong?

He didn't rename. He changed the order of the ones.

He really thought it was O.K. to change the order of the two numbers.

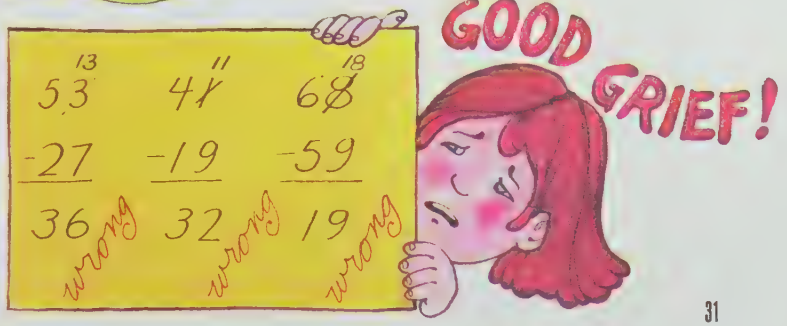
He forgot the story about the cookie jar. If there aren't any cookies, you can't take any cookies.



She is not happy either.
Look at her paper.

What did she
do wrong?

When she renamed 1 ten, she forgot to change the tens.



31

goal Examining common errors made in subtraction with renaming

page 31 Strictly for discussion. *Why is there an error?* Replies should serve as clues to any mislearning.

You will quickly know which pupils have learned to subtract with renaming when the three examples at the bottom are discussed. Reassure those who do not see the error that by the end of this chapter they will be able to find such mistakes.

things bulletin board suggested in the activity for page 23, toy or real money (optional)

Give each child an amount of money for shopping. He may buy 1 thing. Then he must compute his change. If additional practice is needed in actually counting change, practice with the play or real money.

goal Practice in subtracting two 2-digit numbers; checking subtraction by addition

page 32 Let those who can work independently complete the chart. At the same time you can be working with any pupils who need special help and more manipulative experience.

Checking subtraction by addition appears to be magic. Take time to share ideas. Pupils may want to try several more examples to make sure the check works. Present at least one rigged problem, such as $50 - 27 = 37$, to make sure the pupils are actually completing the computation rather than just playing with the order of numbers.

8 people were each supposed to sell at least 45 tickets for the raffle. Find out how many tickets each person had yet to sell.

		Number of tickets to be sold	Number of tickets sold	Number yet to sell
1.	Herb	45	26	? 19
2.	Sue	45	35	? 10
3.	Bob	45	24	? 21
4.	Kay	45	40	? 5
5.	John	45	37	? 8
6.	Linda	45	31	? 14
7.	Roy	45	28	? 17
8.	Helen	45	29	? 16

Both John and Helen say that you made a mistake.
The numbers you have for them are wrong. Are they? Discuss.
How can you prove that you are right? At this point the pupils will suggest that they would have to do the problem again.

Look at a simple problem.

Does $8 - 5 = 3$? Yes
Check by asking, "Does $3 + 5 = 8$?"
Does it? Is the subtraction then correct? Yes
Yes

Adding the number that was taken away is a good way to check.

John

$$\begin{array}{r} 45 \\ -\ 37 \\ \hline ?? \end{array} \quad \text{your answer} \rightarrow \quad \begin{array}{r} 8 \\ ?? \\ +\ 37 \\ \hline 45 \end{array}$$

8

Helen

$$\begin{array}{r} 45 \\ -\ 29 \\ \hline ?? \end{array} \quad \text{your answer} \rightarrow \quad \begin{array}{r} 16 \\ ?? \\ +\ 29 \\ \hline 45 \end{array}$$

16

Did you make an error on the number of tickets yet to be sold? Discuss.

32

lesson Pages 33, 34, 35

goal **Progress Check**—addition and subtraction with renaming

page 33 Be careful of the operation signs! Watch those directions too! No one wants to do more problems than he or she should.

The last question could start a good discussion. Have the pupils prove their charges. Have no fear! The two problem sets have been rigged. Look!

Girls	Boys
44	54
−19	−19
29	39
+19	+19
53	17
+17	+53

WATCH OUT!

GIRLS

do this set. Look at the signs.

	a	b	c
1.	44 − 19 = 25	29 + 19 = 48	37 − 18 = 29
2.	53 + 17 = 70	21 − 18 = 13	31 − 29 = 12
3.	17 + 39 = 56	36 + 47 = 83	50 − 24 = 36

BOYS

do this set. Look at the signs.

	a	b	c
1.	57 − 18 = 39	39 + 17 = 56	54 − 19 = 35
2.	41 − 18 = 23	17 + 53 = 70	31 − 29 = 12
3.	39 + 19 = 58	47 + 36 = 83	50 − 27 = 23

Look at the two sets of problems. Who do you think had the easier problems to do?

Each had 4 addition and 5 subtraction problems, and in the subtraction 5 problems in each set had renaming.

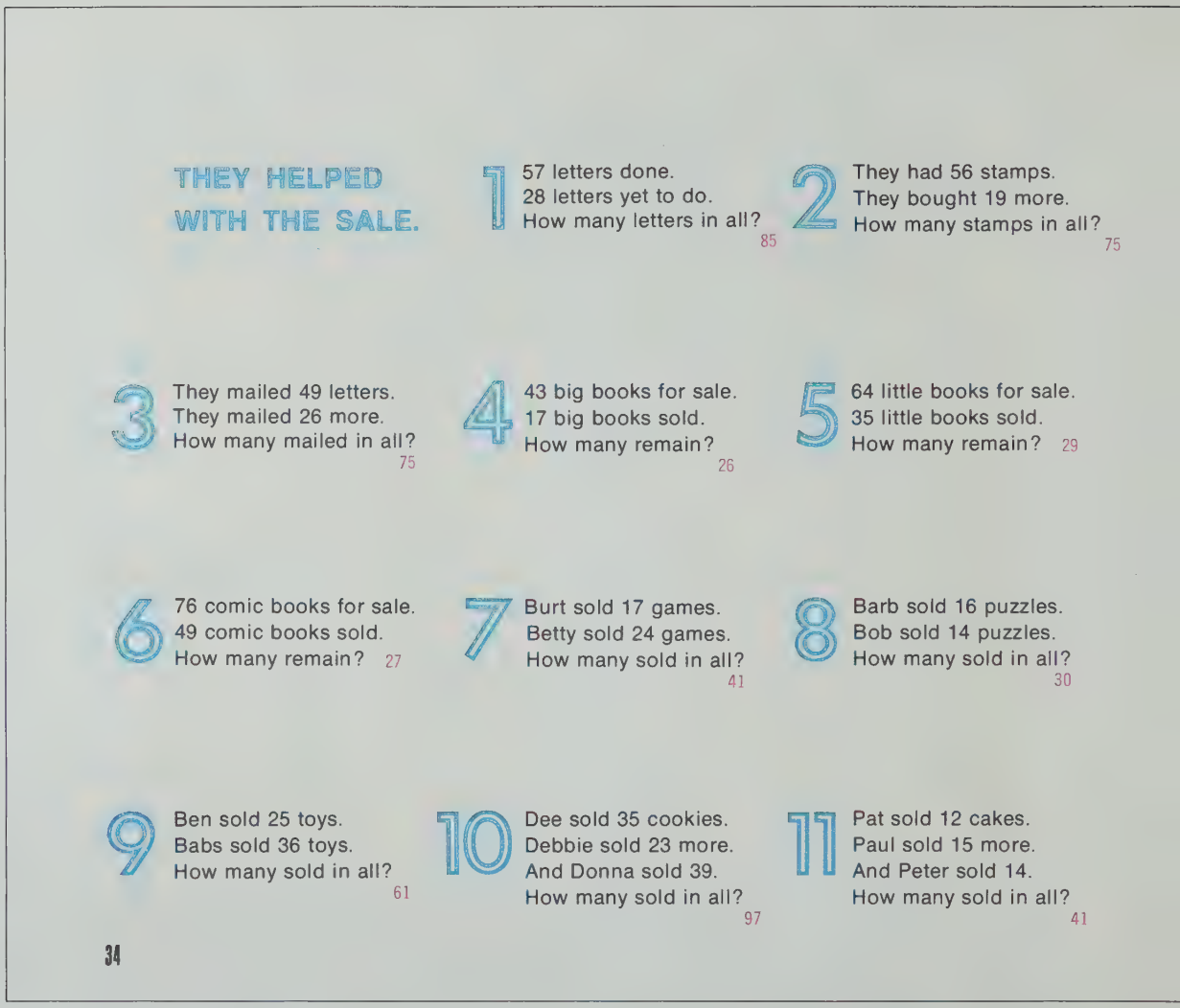
33

See activity 10, page 36c.

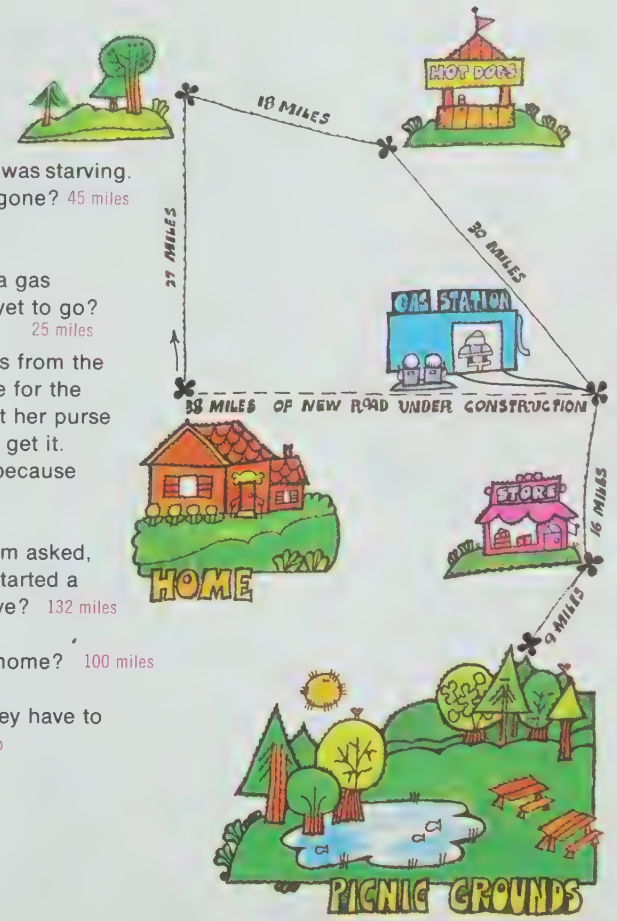
See activity 11, page 36d.

goal Practice in solving word problems with addition and subtraction

page 34 Before this page is started, you may want to have a hunt for word clues that signal addition or subtraction. Careful—don't be fooled.



The Smiths ate breakfast, and then they were off for their family reunion.



1. Junior saw a hotdog stand. He said he was starving. He wanted to stop. How far had they gone? 45 miles
   They didn't stop!

2. The car had a flat tire. But there was a gas station handy. How far did they have yet to go? 25 miles

3. They stopped at a store just nine miles from the picnic grounds. They bought some ice for the lemonade. Mom discovered she forgot her purse at the gas station. They drove back to get it. How many extra miles did they drive because Mom forgot her purse? 32 miles

4. They finally got to the picnic. Uncle Jim asked, "How far did you drive today?" This started a family argument. How far did they drive? 132 miles

5. How many miles must they go to get home? 100 miles

6. When the new road is finished, will they have to drive as far to the picnic grounds? No
   How many miles less? 37 miles

35

goal Using addition and subtraction to solve problem situations

page 35 This page requires some sophisticated thinking. You may want to have a group work together to solve these problems.

lesson Page 36

goal **Checkout**—adding and subtracting two 2-digit numbers

page 36 Discuss the title **Checkout** with everyone. Reassure them—there is no need to be uptight. Let pupils look back in their book for help if they want to. Those who have not mastered these skills will have another chance later.

Try to pinpoint the learner's trouble. Problems requiring renaming are labeled in the answer key. Watch for pupils who did not follow the operation sign.

$$\begin{array}{r} 80 \\ -11 \\ \hline 91 \end{array}$$ Added instead of subtracted.

Look for those who reverse numbers.

$$\begin{array}{r} 60 \\ -25 \\ \hline 45 \end{array}$$ Subtracted $$\begin{array}{r} 5 \\ -0 \\ \hline \end{array}$$ rather than rename.

And watch for those who did not rename in addition.

$$\begin{array}{r} 15 \\ +25 \\ \hline 310 \end{array}$$

Problems that require renaming should quickly identify those who have not mastered the basic facts.

CHECKOUT

You go to the store and pick out the things you need.
In some stores you take the things to a checkout counter.
You pay for the things. Then they are your very own.

You have picked out some new skills in the math store.
This page will be your checkout.
It will help you decide which skills are your very own.
And it will help you decide which skills need more practice.
You'll have time for more practice. So don't worry.

Add these.

Skills: Addition of 2-digit numbers, no renaming — Addition of 2-digit numbers, renaming

	1.	2.	3.	4.	5.
	t o	t o	t o	t o	t o
	3 4	4 1	7 5	1 5	2 7
	+ 6 0	+ 2 5	+ 6	+ 2 5	+ 7 5
	9 4	6 6	8 1	4 0	10 2

Subtract these.

Skills: Subtraction of 2-digit numbers, no renaming — Subtraction of 2-digit numbers, renaming

	6.	7.	8.	9.	10.
	t o	t o	t o	t o	t o
			8 13	5 10	6 12
	8 4	6 7	~~9~~ ~~3~~	~~6~~ ~~0~~	~~7~~ ~~2~~
	− 6 0	− 4 1	− 2 6	− 2 5	− 5 9
	2 4	2 6	6 7	3 5	1 3

Watch out for these! Look at the signs. Skill: Mixed practice with and without renaming

	11.	12.	13.	14.	15.
	t o	t o	t o	t o	t o
	7 10				8 10
	~~8~~ ~~0~~	7 6	2 3	8 1	~~9~~ ~~0~~
	− 1 1	− 2 0	+ 4 9	− 5 1	− 7 4
	6 9	5 6	7 2	3 0	1 6

36

See activity 12, page 36d.

See activity 13, page 36d.

RESOURCES

another form of evaluation

for Progress Check—page 9
Add.

Set 1

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	1	5	4	3	2	3	5	1
	+3	+4	+3	+2	+4	+5	+2	+5
	4	9	7	5	6	8	7	6
2.	5	4	3	4	0	2	4	3
	+3	+2	+0	+4	+5	+3	+1	+4
	8	6	3	8	5	5	5	7

Set 2

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	9	8	6	7	5	7	4	6
	+2	+0	+3	+2	+6	+3	+9	+4
	11	8	9	9	11	10	13	10
2.	7	2	8	9	5	4	1	8
	+5	+8	+3	+6	+5	+7	+9	+4
	12	10	11	15	10	11	10	12

Set 3

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	8	3	4	8	3	5	3	6
	+2	+9	+5	+5	+8	+9	+7	+2
	10	12	9	13	11	14	10	8
2.	0	4	9	5	3	4	5	9
	+9	+8	+1	+7	+9	+6	+8	+4
	9	12	10	12	12	10	13	13

Set 4

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	9	8	6	7	6	7	9	8
	+8	+6	+6	+8	+8	+7	+6	+9
	17	14	12	15	14	14	15	17
2.	7	6	8	9	8	9	7	6
	+9	+7	+7	+9	+8	+7	+6	+9
	16	13	15	18	16	16	13	15

for Progress Check—page 15
Check your subtraction skill.

Set 1

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	9	6	8	7	7	8	5	9
	−5	−2	−6	−4	−1	−5	−3	−6
	4	4	2	3	6	3	2	3
2.	8	9	6	7	7	6	9	8
	−2	−7	−0	−5	−3	−4	−2	−3
	6	2	6	2	4	2	7	5

Set 2

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
1.	10	12	11	14	11	13	15
	−5	−6	−4	−5	−3	−5	−6
	5	6	7	9	8	8	9
2.	12	10	11	10	12	13	11
	−4	−2	−2	−7	−3	−4	−5
	8	8	9	3	9	9	6

Set 3

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
1.	10	11	10	12	12	13	11
	−9	−6	−7	−5	−8	−8	−8
	1	5	3	7	4	5	3
2.	13	11	12	11	10	12	13
	−8	−7	−9	−9	−4	−7	−7
	5	4	3	2	6	5	6

Set 4

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
1.	16	14	15	17	13	16	14
	−8	−7	−9	−8	−9	−7	−9
	8	7	6	9	4	9	5
2.	15	13	14	16	15	17	15
	−8	−6	−8	−9	−7	−9	−6
	7	7	6	7	8	8	9

for Progress Check—page 23
Add.

	(a)	(b)	(c)	(d)	(e)
	t o	t o	t o	t o	t o
1.	2 9	2 6	4 7	1 5	7 8
	+4 3	+5 7	+2 3	+5 5	+1 3
	1 2	1 3	1 0	1 0	1 1
	6	7	6	6	8
	7 2	8 3	7 0	7 0	9 1
	t o	t o	t o	t o	t o
2.	2 6	6 6	4 3	1 8	5 9
	+3 8	+2 9	+3 9	+3 5	+2 7
	1 4	1 5	1 2	1 3	1 6
	5	8	7	4	7
	6 4	9 5	8 2	5 3	8 6

for Progress Check—page 26
Subtract.

	(a)	(b)	(c)	(d)	(e)
	t o	t o	t o	t o	t o
1.	3 9	4 7	6 5	8 7	9 9
	−1 2	−3 6	−5 5	−1 1	−9 5
	2 7	1 1	1 0	7 6	4
	t o	t o	t o	t o	t o
2.	5 6	3 8	7 9	5 6	4 7
	−2 6	−2 4	−5 3	−3 1	−1 4
	3 0	1 4	2 6	2 5	3 3
	t o	t o	t o	t o	t o
3.	7 9	5 8	9 6	4 6	8 8
	−2 4	−4 3	−7 3	−2 4	−2 0
	5 5	1 5	2 3	2 2	6 8
	t o	t o	t o	t o	t o
4.	9 1	6 5	8 5	2 9	7 8
	−8 1	−2 1	−5 0	−1 6	−3 6
	1 0	4 4	3 5	1 3	4 2

for Progress Check—page 33
Compute. Watch out! Look at the signs.

	(a)	(b)	(c)	(d)
1.	t o 3 7 + 4 8 1 5 7 8 5	t o 8 0 − 3 6 4 4	t o 7 4 − 2 8 4 6	t o 2 3 + 4 7 1 0 6 7 0
2.	t o 6 3 − 2 7 3 6	t o 1 6 + 7 7 1 3 8 9 3	t o 6 2 − 3 9 2 3	t o 6 8 + 1 5 1 3 7 8 3

for Checkout—page 36
You've picked up some new math skills. This page is your checkout. It will tell you which skills you still need practice in.

Add.

1.	2.	3.	4.	5.
t o 5 0 + 3 9 8 9	t o 6 3 + 3 4 9 7	t o 8 6 + 7 9 3	t o 7 5 + 1 5 9 0	t o 3 4 + 6 9 10 3

Subtract.

6.	7.	8.	9.	10.
t o 5 4 − 1 0 4 4	t o 8 8 − 2 7 6 1	t o 7 3 − 5 7 1 6	t o 6 0 − 3 6 2 4	t o 9 5 − 4 7 4 8

Watch out! Look at the signs.

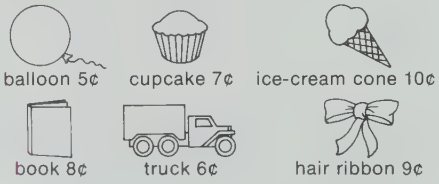
11.	12.	13.	14.	15.
t o 4 0 − 2 2 1 8	t o 8 4 − 4 0 4 4	t o 4 9 + 3 7 8 6	t o 7 8 + 1 8 9 6	t o 9 7 − 6 9 2 8

activities

1. things pictures of things (or actual objects) the pupils would be interested in buying

Display the pictures or things on a bulletin board. Have the youngsters decide on reasonable prices for each object and then attach a price tag. *You can buy any 2 things you want. How much will they cost?* Have the pupils write the sentence—but only if you feel sentence-writing practice is needed.

You may want to change pictures and prices to provide more practice.



2. things for each pair of pupils: 1 set of numeral cards 0 through 18

Pair pupils. They are to spread the cards on a table so that every numeral can be seen. The first player picks up any 3 cards that can be used to form an addition sentence. He says the sentence aloud. If he is not challenged by the other player, he keeps the 3 cards.

The second player takes his turn and follows the same procedure. If his sentence is correct, he keeps the cards.

If any sentence formed is not correct, the other player has a chance to correct it by selecting the correct card. He then keeps the 3 correct cards and gets his own next turn also. If no card is available to change the sentence into a correct sentence, the sentence may be corrected aloud and the "wrong" card put back into the center. The challenger does keep the other 2 cards.

Play continues until no more addition sentences can be formed. The winner is the one with the most cards.

3. things small box, index cards or half-sheets of paper

Start a problem box for the room. Everyone should share in the planning. *We need a source of problems. I'll bet you can do a good job of making up problems! Each one of you can do some.* Write the problems on 1 side of the card, the answers on the other.

Here's a set of problems to get everyone started. What are all sets of 3 numbers—each number less than 10—that will add to 18? to 17? to 16? to 15? to 14? to 13? to 12? to 11? to 10?

Word problems are needed too! Get the bagful of problems written for the activity suggested on page 7. Have the youngsters sort these, select the best ones, copy each one on a card, and write the answer on the back.

4. things strips of paper

Form groups of 4 or more pupils. Agree on a pattern for exchanging papers at 3 different times during the activity. The groups may decide, for example, to pass their papers first to the person to the right, then to the person immediately in front, then to the person on the left.

To begin, each pupil folds his strip of paper into 4 same-size parts, forming a column of boxes. Then he writes any numeral less than 10 in the first box. Exchange for the first time. *On the paper you receive there will already be 1 numeral. Write a numeral less than 10 in the second box.* Exchange papers for the second time. *On the paper you receive there will already be 2 numerals. Write a numeral less than 10 in the third box.* Exchange papers for the third time. *Find the sum of the 3 numbers on the paper you receive.*

Repeat, using the clean side of the paper. Complete at least 5 rounds. Then let each child decide which problem was the hardest to compute. You may want to make a list of these and use them on another day.

5. things subtraction fact cards (no answers visible); numeral cards 0 through 9

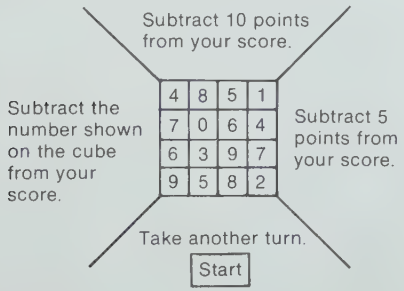
Pair pupils who need to practice the same or similar subtraction facts. Select and match 12 facts and 12 appropriate numeral cards to serve as answer cards. Keep the sets of cards separated. The cards are placed facedown on the table and arranged in rectangular arrays —one array containing the fact cards, the other array containing the answer cards.

Players alternate in selecting a card from each array, turning the cards faceup, and deciding whether or not the answer matches the problem. If the cards match, they are removed and held by the player. If the cards do not match, they are turned facedown again and remain in play. The player with the most cards after all the cards have been matched wins.

It pays to remember which cards are where when trying to make a match!

6. things game board, wood cube

Number the faces of a wood cube as follows: 4, 5, 6, 7, 8, 9. Prepare a game board (or have the youngsters do it), as shown.


Subtract 10 points from your score.
Subtract the number shown on the cube from your score.
4 8 5 1
7 0 6 4
6 3 9 7
9 5 8 2
Subtract 5 points from your score.
Take another turn.
Start

Rules:

- In turn, roll the cube from the **start** position.
- Add the number that lands faceup on the cube to the number on which the cube lands.
- If the cube touches 2 or more numbers, add all the numbers touched to the number that is faceup on the cube.
- If the cube lands in a section with special directions, follow those directions.
- The first player to reach 100 points (or any other number chosen) wins.

7. things place-value chart, play or real money—pennies, dimes, dollars

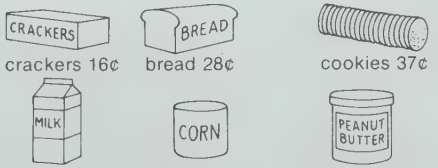
With youngsters who appear to have no background in place value, use a money approach. Have a child show 27 pennies. *Do you have enough pennies to exchange for a dime?* Have the child actually do the exchanging step. *Do you have enough for another dime?* When the exchanging is completed, have the child show the number of dimes and pennies as tens and ones in a place-value chart.

Once the youngster has a firm foundation with 2-digit numbers, expand to 3-digit numbers, exchanging 10 dimes for a dollar. Dollars will then represent hundreds—100 pennies.

8. things pictures of grocery-store items, or empty containers

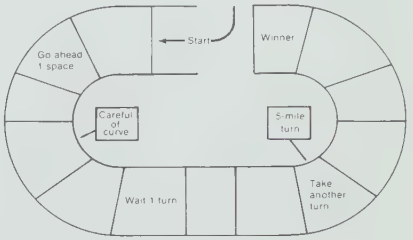
Display the pictures or empty containers. Have the youngsters decide on appropriate prices—they may need to do some research in order to reach a decision—and attach price tags. Let them shop for only 2 things at a time. More capable youngsters may want to buy more—let them, if they can do the computation.

Changing pictures will provide additional practice for several days. These items will be used again on page 31.



9. things for each pair of pupils: index cards, large sheet of paper, markers of 2 colors

Have each youngster who is having trouble with specific facts write these facts on cards, 1 per card—limit 10. Have him write his initials in one corner. Pair pupils of similar ability. Have them design a roadway on the large sheet of paper. They may want to include some special directions.



Have each pair of pupils mix their cards and place them facedown in a stack. Pupils alternate drawing a card, giving the answer, and moving 1 space if correct. For some pupils charts may be necessary to verify the answers. Each time the opponent is the checker. As the cards are used, place them at the bottom of the stack so that the pupils continually meet those facts causing them the most trouble. The first to get to the end is the winner.

Cards can be separated by the initials in the corner and kept for more practice.

10. things bundles of 10, single counters, rubber bands

Bring out those bundles of 10 and use a manipulative approach with the child who seems lost. Mastery of the addition facts is prerequisite. Have the youngster show 36 and 9 more. Reinforce the algorithm by having him add the ones first.

Do you have more than 10 ones? Make a bundle of 10. Put it with the tens. Now how many ones? tens? How many in all? Repeat.

Next combine manipulatives with recording.

tens	ones	
3	6	
+	9	
1	5	*Record ones.*
3		*Record tens.*
4	5	*How many in all?*

Where do you see this 1 ten in your collection of counters?

Make a bundle of 10. *How many tens in all?* Complete recording the answer.

Repeat for several examples. Then have the child try to complete a problem without manipulatives.

When the youngster can work successfully, he is ready to add two 2-digit numbers with renaming. Use manipulatives and repeat the same steps.

This same technique may be applied to subtraction. Mastery of subtraction facts is prerequisite. Have the youngster show 35. Ask him to give you 7. He will have to break a bundle of 10. Move on to the written algorithm.

tens	ones
3	5
−	7

Can you take 7 from 5? Break up a ten.
Record the renaming.
Complete the subtraction.

Use manipulatives as long as is necessary. When the youngster can operate with understanding, move to subtracting two 2-digit numbers.

11. Use only the numbers from 0 through 15. The goal is to write one number in each box so that the sum of each row, each column, and each diagonal is 30. One more rule—the sum of the numbers in the four corner boxes also must be 30.

0	13	10	7
11	6	1	12
5	8	15	2
14	3	4	9

Solution

12. things play money—dimes, pennies

Play money is a useful aid in adding and subtracting 2-digit numbers, especially when renaming is required. The coins can be cut from construction paper and marked with a felt pen. Each pupil will need 10 dimes and 20 pennies.

For addition, have the pupil show the problem with coins while you record.

2 dimes 3 pennies
and *3 dimes 9 pennies*

How many pennies in all?
How many dimes in all?
Do you have enough pennies to exchange for a dime? Do it. How much money in all?
Repeat for several examples. Next move to written problems, using the algorithm.

tens	ones
2	3
+ 3	9

How many ones?
How many tens?
How many in all?

This technique works for subtraction also.

5 dimes 4 pennies
take away 2 dimes 7 pennies

Begin with the pennies. Can it be done? *What will you do?* A dime will have to be exchanged for 10 pennies. Complete the answer. When the youngster can operate with confidence, move to the written algorithm for additional practice.

13. things large piece of heavy paper, 2 or 3 rubber jar rings

Have pupils make a calendar for the month on the paper. The calendar becomes the game board. The rubber rings are tossed onto the calendar to generate problem numbers.

2 rings—add or subtract the numbers.
3 rings—add the numbers.

In each case the answer is the pupil's score. Predetermine a rule for rings that land on 2 or more numbers—toss again, add all the numbers, or whatever rule the youngsters decide on. Adding all the numbers can turn into quite a challenge.

additional learning aids

operation—chapter objectives 1, 2, 3, 4

SRA products

Arithmetic Fact Kit, SRA (1969)
Addition cards: all
Subtraction cards: 2–24
Computapes, SRA (1972)
Module 1, Lessons: AS 2, 3, 4, 5, 8, 9, 13, 14, 15, 16, 17, 18, 19
Module 2, Lessons: AS 21, 29, 32
Cross-Number Puzzles (Whole Numbers), SRA (1966)
Addition cards: 1, 5
Subtraction cards: 1, 3
diagnosis: an instructional aid—Mathematics Level A, SRA (1973)
Probes: L-1, 2, 10, 11, 15
Mathematics Involvement Program, SRA (1971)
Cards: 32, 42, 52, 102, 132, 142, 152, 252, 13, 23, 33, 63, 83, 113, 124, 165
Skill through Patterns, level 3, SRA (1974)
Spirit masters: 3, 4, 5, 6, 7, 11, 13, 14, 18, 20, 27
Visual Approach to Mathematics, level 3, SRA (1967)
Visuals: 2, 5, 7

other learning aids (described on page 72d)—Calculator, Cuisenaire* rods, I Win, Mathematical Balance, Mathfacts Games** (levels 3 and 4), Orbiting the Earth (addition and subtraction), Quizmo*** (addition-subtraction), Tally and Difference, Veri-Tech Senior (addition and subtraction books)

* Registered trademark of Cuisenaire Co. of America, Inc.
** Trademark of Milton Bradley Co.
*** Registered trademark of Milton Bradley Co.

2 MULTIPLICATION

before this chapter the learner has—

1. Found the sum of three 1-digit numbers
2. Counted by 2s, 3s, 5s, and 10s

in chapter 2 the learner is—

1. Developing an understanding of the concept of multiplication
2. Saying or writing the multiplication fact for an array.
3. Making an array for a multiplication fact
4. Solving word problems that involve multiplication

in later chapters the learner will—

1. Master the multiplication facts
2. Find the product of a 1-digit factor and a 2-digit factor

Notes & Things

This chapter explores the concept of multiplication and not much more. This new operation is a BIG idea for children. They need lots of time to play with adding same-size sets, to make arrays, to practice skip-counting, and to find out when this thing called multiplication can be used. Let this chapter be full of talk and sharing ideas.

All the number facts are presented in this first chapter on multiplication. But please don't panic. The pupils are not expected to master the facts now. It's much too early. They have some grownup words to learn, such as *factor* and *product.* And they will be using models that are also brand-new. The multiplication symbol will be introduced in the number sentence. There are so many multiplication situations that some pupils may pick up the facts on their own. Wouldn't that be lovely? It is appropriate to begin practice on the facts, but be careful of pressure situations that can be created for the child.

Pupils may quickly see how the commutative, or order, property pops up when they use arrays. And you will notice that multiplication by zero and one is hit head-on in the chapter. Finding out both the similarities to and differences from addition is important in this early stage of concept development.

The overhead projector can be a big help to you in this unit. Take time to prepare at least one transparency that you can use as a basis for several lessons. It should be a 10-by-10 grid. Make the squares large enough so that your favorite counters will fit inside. You will then be able to quickly display an array of any appropriate size. Having strips of heavy acetate can also be a big help. Two strips of 2 squares, three strips of 3 squares, four strips of 4 squares, and so on, will let you and pupils use the projector effectively.

Let your imagination go wild as you find manipulatives for same-size sets. The children would love to help you make strings of paper clips. They can put buttons or hard-candy pieces into small pill bottles or baby-food jars and then label the caps with the number inside. Snap beads, those little candies sealed in strips of cellophane, beads tied in bunches, or even bundles of tongue depressors or drinking straws are still more things that can be used for skip-counting practice.

things

felt or magnetic board
index cards
graph paper

For the extra activities you will want to have a deck of playing cards available.

goal Think about and explore ideas through a picture clue

page 37 All those cars, exactly alike and lined up in twos, just have to be fresh off an assembly line. Where do the youngsters think all these cars come from?

The concept of an array is developed on the pages to come, but for now it is more appropriate to find out if the youngsters have any idea how to count objects that are aligned other than counting by ones. *If you saw a long line of these cars, could you count by twos to find out how many in all? Let's find out how far we can count by twos.*

Start the group counting, but let them continue it. Do the majority count to 20 without any difficulty? Stop the counting at a reasonable point and ask them to count by fives and then tens. The final challenge is to try counting by threes. Keep this activity full of fun and gamelike.

Then take up the idea of cars lined up in a parking lot. Quickly sketch a 3-by-4 array. (Better yet, have a transparency prepared.) Ask how many cars in the parking lot. Put two more "cars" in each row. Ask how many. Add another row to your array. Again, ask how many.

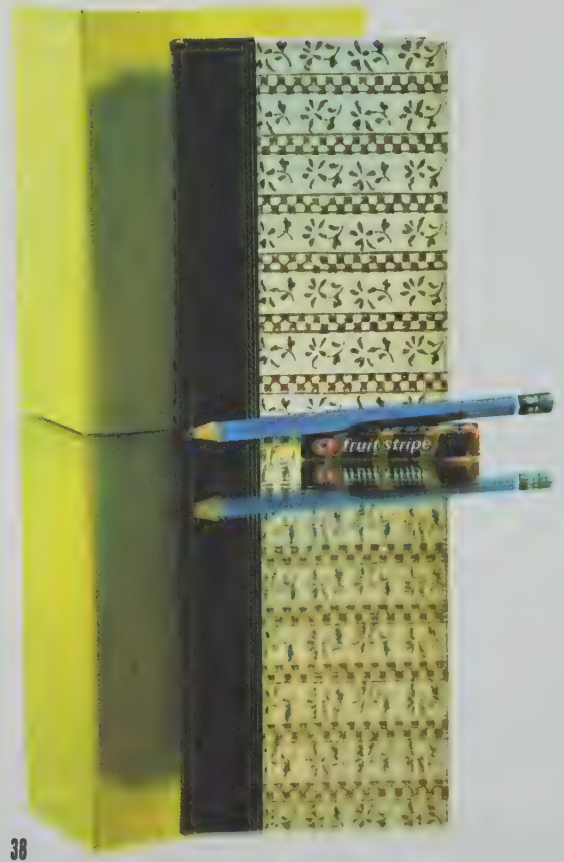
You'll be able to spot your sharpies as well as those youngsters who are not involved. On to the next page. Your challenge will be clear.

lesson Pages 38, 39, 40

goal **Survey**—knowledge of the concept of multiplication

memo The ease with which the youngsters reply to the questions on pages 38 and 39 will indicate the pace for this chapter.

page 38 Handle the word problems in the way that is best for your group. Watch for those children who use addition to arrive at the answer, those who use skip-counting, and those who use multiplication. Go right on to page 39.



HOW MANY?

1. Lil bought 5 pencils.
   Each pencil cost 5¢.
   How many cents did she spend?
   $5 + 5 + 5 + 5 + 5 = \underline{?}$ 25

2. Jim bought 4 packages of gum.
   Each package cost 8¢.
   How many cents did he spend?
   $8 + 8 + 8 + 8 = \underline{?}$ 32

3. Dan needed 6 books.
   Each book cost 3¢.
   How many cents did he spend?
   $3 + 3 + 3 + 3 + 3 + 3 = \underline{?}$ 18

4. Liz carried 4 boxes.
   Each box weighed 6 pounds.
   How many pounds did she carry?
   $6 + 6 + 6 + 6 = ?$ 24

5 + 5 + 5 + 5

5. Paul delivered a newspaper to every house. He covered 4 blocks. There were 5 houses in each block. How many papers did he deliver? 20

Think about answers for these.

6. Can you figure out a faster way to tell how many?
Multiply—5 · 4 = 20

7. Can you count by 2s? by 3s? by 4s? by 5s?
2, 4, 6, 8 . . . 3, 6, 9, 12 . . . 4, 8, 12 . . . 5, 10, 15 . . .

8. Can you answer these questions?

a 5 times 3 is how many? 15

b 4 times 6 is how many? 24

You'll be able to answer them soon.

You have a
GOAL
Learn how to multiply

39

goal **Survey**—knowledge of the concept of multiplication

memo You may wish to introduce the goal of the chapter if the word **multiply** is brand-new. Tell the youngsters that multiplication is simply a grand and glorious way to work with numbers. Promise that they will find out all about it in no time at all.

page 39 Problems 6, 7, and 8 invite discussion. Try counting by 2s, 3s, 4s, 5s with groups of children. The tempo and sound will tell you whether more practice is needed. Problem 8 will let you know whether anyone has previous experience with multiplication. Be sure that the responses to this problem are put into the proper framework to establish the learning goal for everyone.

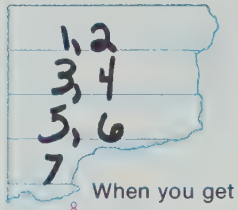
goal Practice in skip-counting as readiness for multiplication

page 40 The ability to count by 2s, 3s, 4s, and so on, will be a great asset to pupils as they work with sets of 2, of 3, and of 4 in multiplication. The page is designed to help youngsters see how such counting patterns develop, as well as to provide them with a practice model.

You may wish to give directions for exercises 1 through 4 verbally, so that the pupils can be free to write. Practice skip-counting aloud: children love the **chanting** sound. Practice with lists and without. Pupils who are weak in this skill will need to practice a few minutes each day for several days.

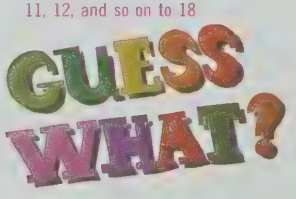
Exercise 7 is a challenge. *Any ideas on how the list for 6 can be made?* Your most capable students may want to go even higher.

1. You will need 9 lines on your paper.
Write the numerals in order from 1 to 18.
Put only two on each line.

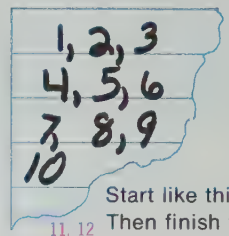


8
9, 10
11, 12, and so on to 18

When you get to here, you are on your own.



2. Start over. You will need 9 lines again.
Write the numerals in order from 1 to 27.
Put only three on each line.



11, 12
13, 14, 15
16, 17, 18, and so on to 27

Start like this.
Then finish the job.

Your job goes on.

3. Write 1 to 36. This time put four numerals on each line.
1, 2, 3, 4
5, 6, 7, 8
9, 10, 11, 12, and so on to 36

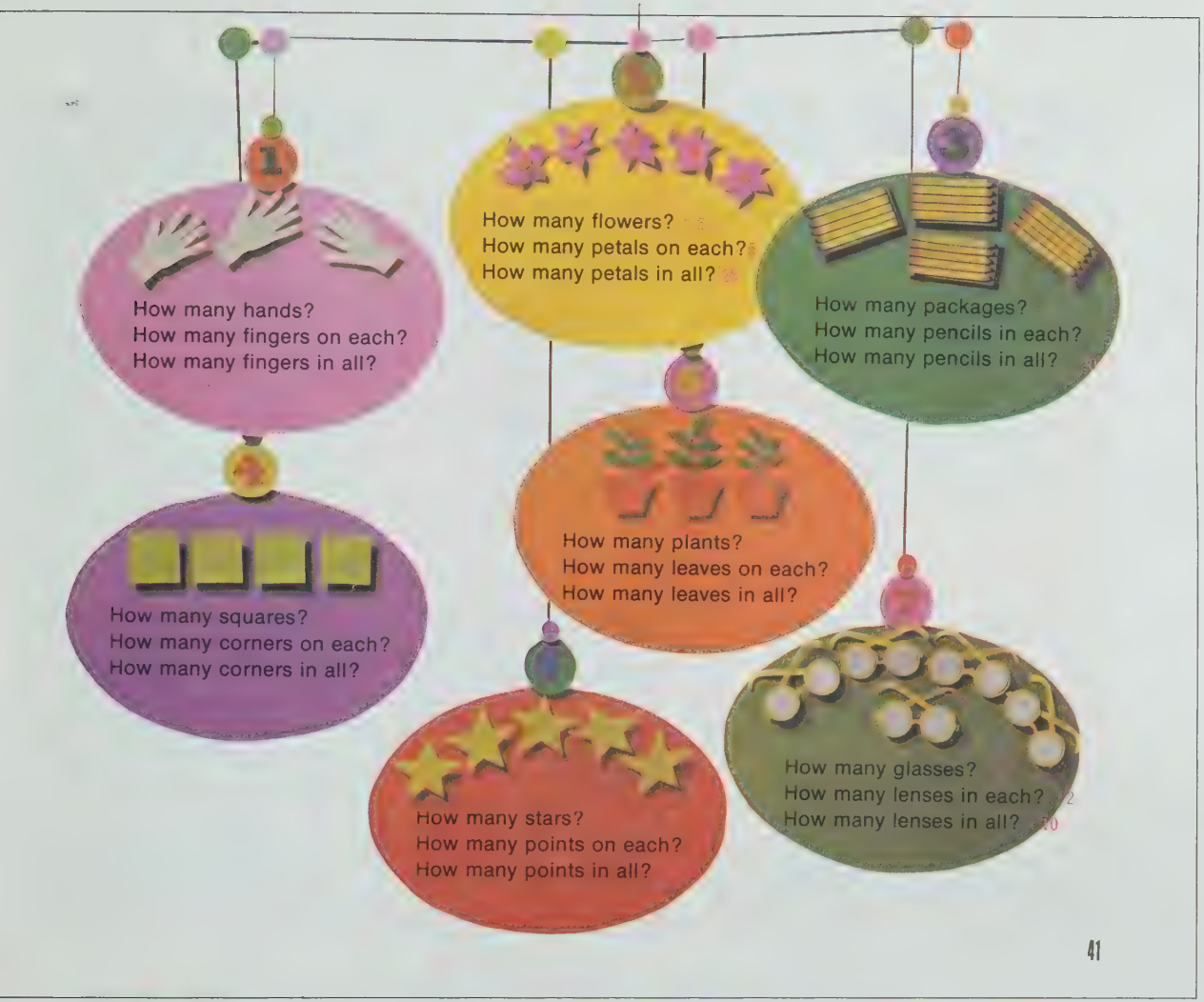
4. 1 to 45. This time put five numerals on each line.
1, 2, 3, 4, 5
6, 7, 8, 9, 10
11, 12, 13, 14, 15, and so on to 45

5. Pretend you have to skip-count by 2s to 18.
Would one of your lists help you?
Yes – the first one you wrote, with 2 on each line

6. Would the lists help you skip-count by 3s? Yes
or by 4s? or by 5s?
Yes Yes

7. Make a list that would help you skip-count by 6s.
1, 2, 3, 4, 5, 6
7, 8, 9, 10, 11, 12
13, 14, 15, 16, 17, 18, and so on to 54

40


How many hands?
How many fingers on each?
How many fingers in all?
How many flowers?
How many petals on each?
How many petals in all?
How many packages?
How many pencils in each?
How many pencils in all?
How many squares?
How many corners on each?
How many corners in all?
How many plants?
How many leaves on each?
How many leaves in all?
How many stars?
How many points on each?
How many points in all?
How many glasses?
How many lenses in each?
How many lenses in all?
41

See activity 1, page 51a.

A special challenge for after school. Find out how many wheels are on—

- A train boxcar
- The trailer of a semitrailer truck
- A 747 jet airplane
- A house trailer (mobile home)

Then investigate how many wheels there would be on 2? on 3? 4? 5? 6? 7? 8? 9? 10?

lesson Pages 41, 42, 43, 44

goal Readiness for the concept of multiplication

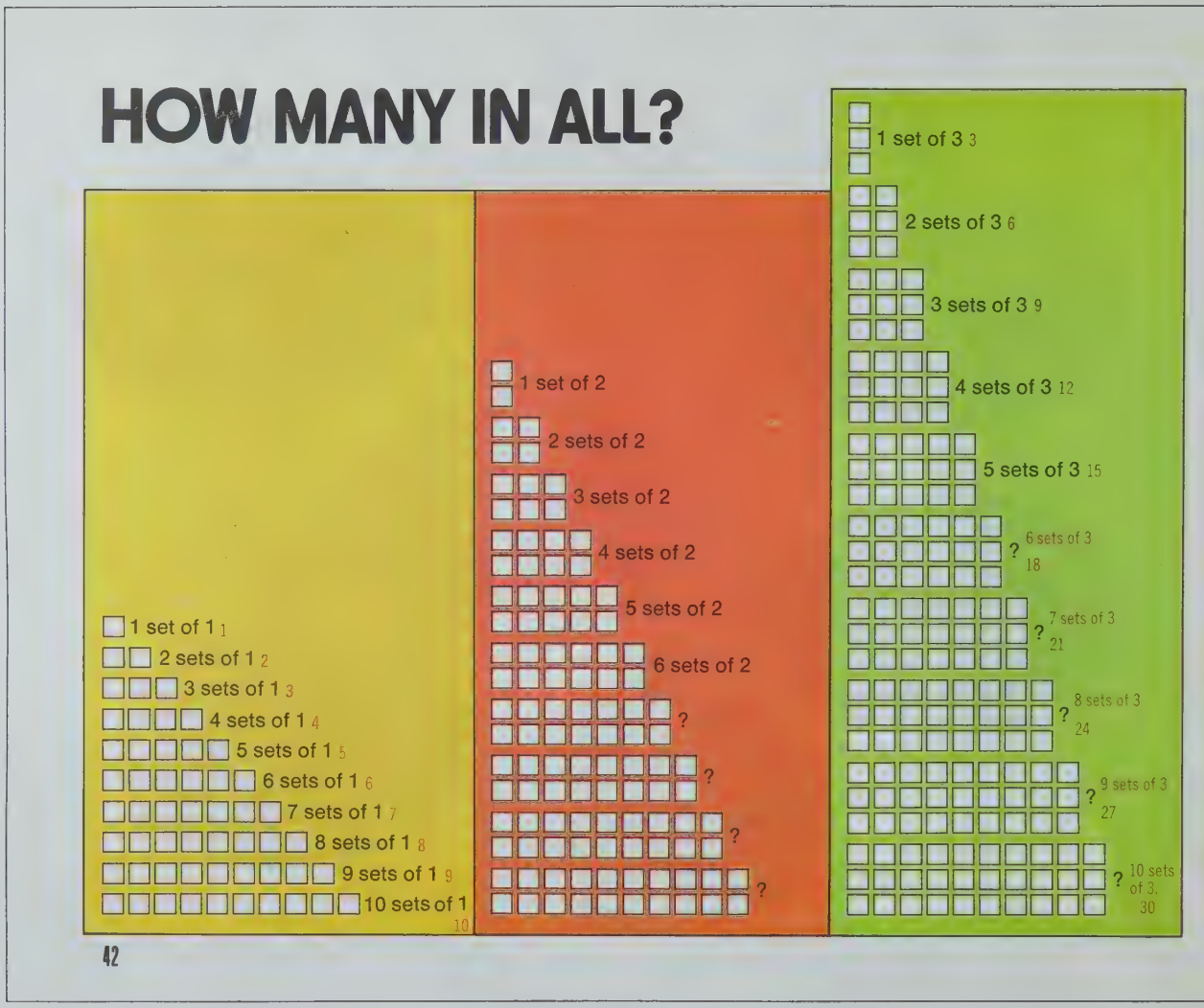
page 41 Children will enjoy sharing their ideas about this page. Some youngsters will count by ones; some will skip-count; some may actually use multiplication to find how many in all. Do not focus on any one method.

Summarize if a youngster has not already done so. *Could we use skip-counting to help us?* Practice counting as a group, using the sets pictured. Counting in unison will eliminate possible embarrassment for any youngsters who have not had adequate experience. Such children will profit from hearing the pattern.

Consider expanding the finger play suggested by the first problem. Make a fist. Open your fingers. Make a fist; open again. Repeat until you show 4 sets of 5 fingers. *How many fingers in all?* Try keeping the thumb tucked under and count sets of 4. Provide sets of like manipulative pieces if more practice is necessary. This is a good time to use a felt or magnetic board.

goal Readiness for the concept of multiplication

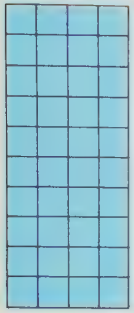
page 42 You may want to use blocks, the chalkboard, or a felt board to show how the sets are built. Point out that with sets of 1, we must count by 1s. With sets of 2, we can count by 1s or by 2s. Which is faster? Use this opportunity to practice counting by 2s and 3s.


HOW MANY IN ALL?
1 set of 1 1
2 sets of 1 2
3 sets of 1 3
4 sets of 1 4
5 sets of 1 5
6 sets of 1 6
7 sets of 1 7
8 sets of 1 8
9 sets of 1 9
10 sets of 1 10
1 set of 2
2 sets of 2
3 sets of 2
4 sets of 2
5 sets of 2
6 sets of 2
?
?
?
?
1 set of 3 3
2 sets of 3 6
3 sets of 3 9
4 sets of 3 12
5 sets of 3 15
? 6 sets of 3 18
? 7 sets of 3 21
? 8 sets of 3 24
? 9 sets of 3 27
? 10 sets of 3. 30
42

Complete

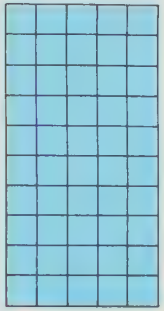
Tell how many squares in all.

1.



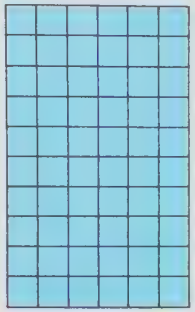
4
8
12
16
a 20
b 24
c 28
d 32
e 36
f 40

2.



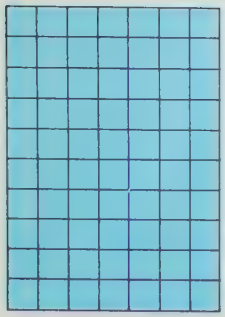
5
10
15
20
a 25
b 30
c 35
d 40
e 45
f 50

3.



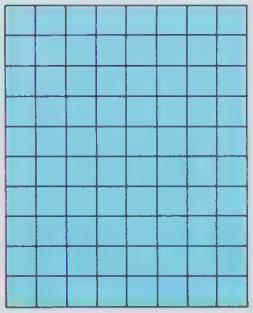
6
a 12
b 18
c 24
d 30
36
42
48
54
60

4.



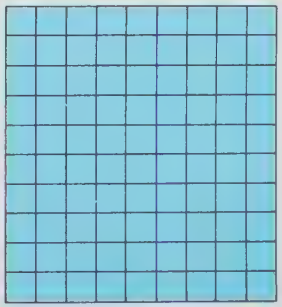
7
a 14
b 21
c 28
d 35
42
49
56
63
70

5.



8
a 16
b 24
c 32
d 40
48
56
64
72
80

6.



9
a 18
b 27
c 36
d 45
54
63
72
81
90

43

goal Readiness for the concept of multiplication

page 43 Here come the biggies. The purpose is to count in **rows.** Rows go **across.** Each row (for any one problem) has the same number of squares, so skip-counting can be used. It's O.K. to count the squares if necessary.

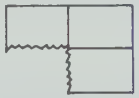
Pupils may record the lists of numbers, one list per **column.** Columns go **down.** Use lined paper folded into **columns.** The work should be independent. Check to make sure that the lists are correct when completed. These can be used as practice models.

Use this opportunity for still more practice in skip-counting. Counting without lists will tell how skilled the youngsters are becoming. Counting by 6s, 7s, 8s, and 9s is difficult and will require much practice. Count sets of real objects whenever possible.

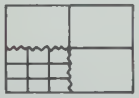
goal Readiness for the concept of multiplication

page 44 This is an activity page. Using only part of a 10-by-10 grid will be difficult if not impossible for many children. Provide them with a means to block out the squares that will not be used. A simple mask can be made quickly and used to cover part of the grid.

Each child will need a piece of paper. Direct the pupils to fold it into four same-size parts and then to carefully tear out one part.



This mask can be laid over the grid in the text so that only the correct number of rows show from the bottom. Moving the mask to the right shows the correct number of squares across. The extra squares are covered.



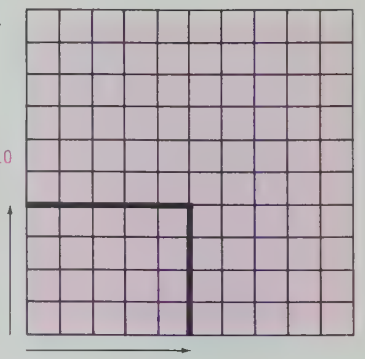
The youngsters can now easily explore all the multiplication facts.

The pictures that you used are O.K.
But they take a long time to draw.
Let's see if there isn't a better way.

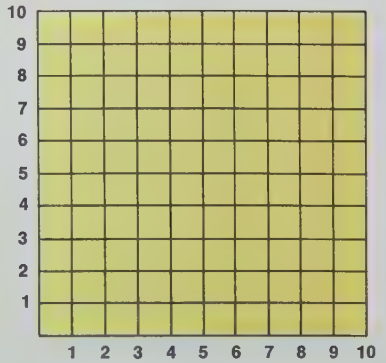
Look at the grid.
How many squares in each row? 10
How many rows? 10

Use only part of the grid.

Count up 4.
Count across 5.
How many squares in all? 20



This idea will work too!
One grid can help with
all numbers up to 10.



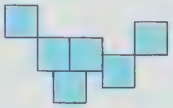
Maybe if we label the grid, it will save you time.

1. Count up 3. Count across 4.
   3 fours are how many? 12
2. Count up 6. Count across 3.
   6 threes are how many? 18
3. Count up 4. Count across 2.
   4 twos are how many? 8
4. Count up 2. Count across 9.
   2 nines are how many? 18

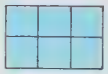
You have heard someone say, "I have to get *organized*".
What does that mean? To put things in some kind of order

Organizing objects into a pattern can help us tell how many.

Are these blocks organized? No
How many blocks? 6



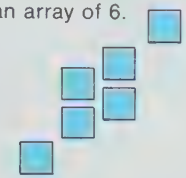
Are these organized? Yes
How many blocks? 6



Some patterns form an array.

This pattern is an array of 6.

This pattern is not an array of 6.



How are these patterns different?
The pattern on the left is organized with the same number in each row and column. The pattern on the right is not.

This pattern is an array.

This pattern is not an array.

How are these patterns different?
The array has the same number of dots in each row and each column. The other pattern has a different number of dots in each row and column.

Make some arrays.

1. Show 5 sets of 4 dots.
   Write how many dots in all. 20
   Also accept

2. Show 4 sets of 5 squares.
   Write how many squares in all. 20

3. Show 3 sets of 2 triangles.
   Write how many triangles in all. 6

4. Show 2 sets of 3 dots.
   Write how many dots in all. 6

5. Show 5 sets of 1 square.
   Write how many squares in all. 5

6. Show 3 sets of 3 triangles.
   Write how many triangles in all. 9

lesson Pages 45, 46

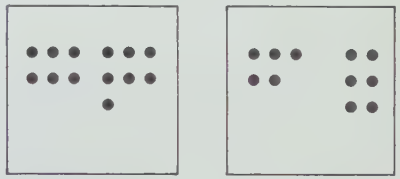
goal Introduction to arrays as a model for multiplication

memo Rectangular arrays are a very useful model for multiplication, **but** they are a very sophisticated model that sometimes makes more sense to adults than to children. Emphasize that in an ARRAY each **row** must have the **same number** of objects.

Please resist the temptation to introduce at this time the notation for multiplication. A little bit more time is needed in developing the concept.

things overhead projector or felt or magnetic board

page 45 Contrasts are presented on the pupil page to establish the new word **array** and its meaning. *How are these patterns different?* If you don't get a quick response, use a felt or magnetic board and present more contrast situations.



To guide thinking, you may want to ask how many rows there are and how many there are in each row.

Have pupils do the problems independently. Provide additional help if it is needed.

goal Practice with arrays

page 46 Think together for problems 1 through 8. Try to observe which youngsters are still counting by 1s to find the answer. Provide these pupils with more practice in skip-counting. Perhaps having a child form his own arrays with counters will help.

Note that in problems 1 through 5 the line of vision is directed **across** the **rows.** The direction changes in problems 9 through 12. Here 5s are seen when one looks **down** the **columns.** Be patient—hold off introducing the multiplication sign for **times.** We'll be there soon.

HERE ARE SOME MORE ARRAYS

1.

$\underbrace{4+4}$

2 sets of 4

How many in all? 8

2.

$\underbrace{4+4+4}$

3 sets of 4

How many in all? 12

3.

$\underbrace{4+4+4+4}$

4 sets of 4

How many in all? 16

4.

$\underbrace{4+4+4+4+4}$

5 sets of 4

How many in all? 20

5.

$\underbrace{4+4+4+4+4+4}$

6 sets of 4

How many in all? 24

6. Could an array show 7 sets of 4? Yes

7. Could an array show 8 sets of 4? Yes

8. Could 9 sets of 4 be shown? Yes

9. 5 is used how many times? 2

2 times 5 is how many? 10

10. 5 is used how many times? 3

3 times 5 is how many? 15

11. 5 is used how many times? 4

4 times 5 is how many? 20

12. 5 is used how many times? 5

5 times 5 is how many? 25

46

A TRAFFIC SIGN SIGNALS US

MATHEMATICS SYMBOLS SIGNAL US

$6 + 3$
+ signals addition.

$7 - 4$
− signals subtraction.

$2 + 4 = 6$
= signals equals.

3×5
× signals multiplication.

Tells how many in each set.
It is also called a factor.

Tells how many sets.
It is called a factor.

Tells how many in all.
This is a product.

$6 \times 3 = 18$

Symbol for *times*.
It signals multiplication.

Symbol for *equals*.
What's on the left is as much as what's on the right.

47

lesson Pages 47, 48, 49

goal Introduction to multiplication as an operation

page 47 For discussion only. Give special attention to the words FACTOR, TIMES, EQUALS, and PRODUCT. These words will be new vocabulary for many youngsters.

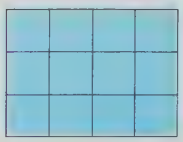
Use a grid again to show $6 \times 3 = 18$. Then use drawings. Show 6 big rings. Put 3 objects inside each ring. Ask how many sets there are. Ask how many there are in each set. Use other examples if you wish, but please make sure that there is enough time to discuss the next page. Let the pupils show off their new words.

goal Practice with multiplication facts

page 48 Here a more organized method of illustrating sets is shown. The symbols used in a multiplication sentence are presented in another way.

This is a fun time—a time to learn and do something new and **grownup.** Please don't require the youngsters to recopy all these columns of facts onto paper at one time. If they complete all the sentences in problem 1, you may want to have the youngsters fold their paper into columns and write only the products for the other problems. Encourage them to use a grid or an array when they don't know the product.

We could add to find how many. But try multiplication.



4 is used how many times? 3

3 times 4 is how many? 12

Use symbols to replace words.

We say 3 times 4 is 12

We can write 3 × 4 = 12

We say 2 times 3 is 6.
We write 2 × 3 = 6.

We say 3 times 2 is 6.
We write 3 × 2 = 6.

Draw an array or use a grid to help you answer these.
Find the products.

1.		**2.**		**3.**		**4.**	
1 × 2 = ?	2	1 × 3 = ?	3	1 × 4 = ?	4	1 × 5 = ?	5
2 × 2 = ?	4	2 × 3 = ?	6	2 × 4 = ?	8	2 × 5 = ?	10
3 × 2 = ?	6	3 × 3 = ?	9	3 × 4 = ?	12	3 × 5 = ?	15
4 × 2 = ?	8	4 × 3 = ?	12	4 × 4 = ?	16	4 × 5 = ?	20
5 × 2 = ?	10	5 × 3 = ?	15	5 × 4 = ?	20	5 × 5 = ?	25
6 × 2 = ?	12	6 × 3 = ?	18	6 × 4 = ?	24	6 × 5 = ?	30
7 × 2 = ?	14	7 × 3 = ?	21	7 × 4 = ?	28	7 × 5 = ?	35
8 × 2 = ?	16	8 × 3 = ?	24	8 × 4 = ?	32	8 × 5 = ?	40
9 × 2 = ?	18	9 × 3 = ?	27	9 × 4 = ?	36	9 × 5 = ?	45

48

1. Use multiplication to solve some word problems.

a She has 2 pockets.
She has 3¢ in each pocket.
How many pennies in all?
$2 \times 3 = ?$ 6

b He has 2 bowls.
He has 2 fish in each bowl.
How many fish in all?
$2 \times 2 = ?$ 4

c They buy 6 bars.
Each candy bar costs 5¢.
How many cents did they pay?
$6 \times 5 = ?$ 30

d There are 4 cars.
There are 6 people in each car.
How many people in all?
$4 \times 6 = ?$ 24

Before you can solve problems quickly,
you need to know multiplication facts.
How many facts do you know now? Find out.

	a		b		c		d	
2.	$2 \times 4 = ?$	8	$5 \times 3 = ?$	15	$4 \times 5 = ?$	20	$3 \times 2 = ?$	6
3.	$3 \times 5 = ?$	15	$4 \times 4 = ?$	16	$2 \times 2 = ?$	4	$4 \times 3 = ?$	12
4.	$2 \times 3 = ?$	6	$5 \times 4 = ?$	20	$2 \times 5 = ?$	10	$3 \times 3 = ?$	9
5.	$4 \times 2 = ?$	8	$3 \times 4 = ?$	12	$3 \times 1 = ?$	3	$5 \times 5 = ?$	25

You may want to use your grid or draw an array for these.

	a		b		c		d	
6.	$3 \times 7 = ?$	21	$5 \times 8 = ?$	40	$2 \times 6 = ?$	12	$4 \times 7 = ?$	28
7.	$5 \times 6 = ?$	30	$4 \times 8 = ?$	32	$3 \times 8 = ?$	24	$2 \times 9 = ?$	18
8.	$4 \times 9 = ?$	36	$2 \times 7 = ?$	14	$5 \times 9 = ?$	45	$4 \times 6 = ?$	24
9.	$3 \times 9 = ?$	27	$2 \times 9 = ?$	18	$3 \times 6 = ?$	18	$5 \times 7 = ?$	35

goal Practice with multiplication facts

memo Please remember that the concept of multiplication is being explored only. The pupils should not be expected to memorize multiplication facts now—that comes later. Let them use manipulatives or a grid when they need help with answers.

things index cards

page 49 Discuss the word problems. Have the youngsters jot down their answers. Now ask them to draw a picture for each word problem. Do the product and the number in each picture match?

Use rows 2 through 5 as a quick check. Expect confidence, but not necessarily speed. Do not expect mastery in rows 6 through 9—not enough practice yet. Make sure that the pupils are not tired or frustrated in completing these rows. It is too early in the game to learn to hate multiplication.

Folded paper and products only, please. Correct the papers at once. Have each pupil make a list of the facts he had wrong. Or he may make flash cards on index cards for additional practice with a buddy. This is probably a good stopping place for a rest.

lesson Pages 50, 51

goal Examining 0 and 1 as factors

page 50 Zero sometimes causes trouble in multiplication. Youngsters confuse addition and multiplication, and 5×0 becomes 5. There is no better way to make the point than with real-world situations in the word problems. Have fun with this part of the page. When it is completed, write the following sentences on the chalkboard and discuss them.

$3 \times 0 =$ _____ $3 + 0 =$ _____
$1 \times 0 =$ _____ $1 + 0 =$ _____
$0 \times 5 =$ _____ $0 + 5 =$ _____
$0 \times 2 =$ _____ $0 + 2 =$ _____

Problems 4 through 6 should be done independently. When the youngsters are finished, ask what happens when 1 is a factor. (The product is the other factor.) *What happens when 0 is a factor?* (The product is 0.)

Find the answer.

1. Peter is to mow the grass.
He gets 2 dollars every time.
Peter is lazy.
He mowed the grass 0 times.
How many dollars did he get paid? 0

2. Roger has to mow the grass too.
His dad won't let him be lazy.
Roger mows the grass for free.
He mowed the grass 5 times.
How many dollars did Roger get paid? 0

3. Draw a picture to show — 0 beads used 3 times
0 beads used 0 times. (Do not let students get too frustrated.)

It's easy to multiply zero.
Any number times zero equals zero.
And zero times any number equals zero.

Find the answer.

4. $1 \times 0 = ?$ 0
$2 \times 0 = ?$ 0
$3 \times 0 = ?$ 0
$4 \times 0 = ?$ 0
$5 \times 0 = ?$ 0
$6 \times 0 = ?$ 0
$7 \times 0 = ?$ 0
$8 \times 0 = ?$ 0
$9 \times 0 = ?$ 0

5. $1 \times 1 = ?$ 1
$2 \times 1 = ?$ 2
$3 \times 1 = ?$ 3
$4 \times 1 = ?$ 4
$5 \times 1 = ?$ 5
$6 \times 1 = ?$ 6
$7 \times 1 = ?$ 7
$8 \times 1 = ?$ 8
$9 \times 1 = ?$ 9

LOOK OUT

6. $8 \times 1 = ?$ 8
$1 \times 8 = ?$ 8
$0 \times 5 = ?$ 0
$1 \times 1 = ?$ 1
$1 \times 9 = ?$ 9
$9 \times 0 = ?$ 0
$0 \times 6 = ?$ 0
$1 \times 7 = ?$ 7
$0 \times 0 = ?$ 0

50

CHECKOUT

We have just started our study of multiplication.
You will see more about this operation on numbers.
Multiplication helps solve a lot of problems like these.
Can you solve them now?

Skill: Word problems solved with multiplication

How much money do you need to buy—

1. 3 globs of bubble gum that cost 5¢ each? 15¢
2. 5 pencils that cost 8¢ each? 40¢
3. 6 lollipops that cost 4¢ each? 24¢
4. 7 used comic books that cost 5¢ each? 35¢
5. 3 stamps that cost 8¢ each? 24¢
6. 4 apples that cost 7¢ each? 28¢
7. 5 mystery packages that cost 9¢ each? 45¢

51

See activity 2, page 51a.

See activity 3, page 51a.

goal **Checkout**—concept of multiplication

memo This chapter has explored the concept of multiplication. No mastery of facts is expected. Addition can be used to solve each of the problem situations presented. Does the learner **think** to use multiplication? Does he know **how** to use multiplication in each situation? He may know how to use multiplication, but he may get a wrong product. We'll focus on multiplication facts in chapter 7.

page 51 Handle these word problems in the way that is best for your pupils. You may want answers only, answers and multiplication sentences as well, or pictures.

RESOURCES

another form of evaluation

for Checkout—page 51
Can you solve these multiplication problems now? Find out.

1. 4 packs of gum, 8 sticks each.
   How many sticks? 32
2. 3 shelves of games, 4 games on each.
   How many games? 12
3. 5 stacks of 5 pennies.
   How many pennies? 25
4. 2 rulers, 6 inches each.
   How many inches? 12
5. 1 pad with 9 sheets of paper.
   How many sheets? 9
6. 3 candy bars, each cut into 3 pieces.
   How many pieces? 9
7. 2 teams, 9 players each.
   How many players? 18

activities

1. things counters and a magnetic board, flannel board, or overhead projector

Show the following sets.

How can you find how many counters in all? (Count them—1, 2, 3, . . ., 9; add them—(3 + 4) + 2 = 9.)

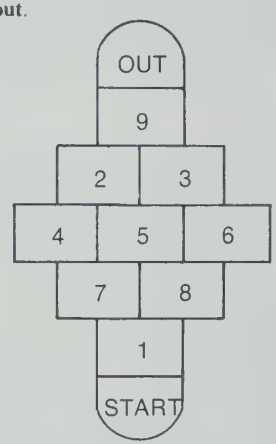
Can you move 1 counter so that all the sets will have the same number?

Is there a different way that you can use now to find how many in all? (Multiply—3 × 3 = 9)

Use similar examples to stress the idea that the sets or groups must all contain the same number in order to be multiplied.

2. things hopscotch design

Draw or tape a hopscotch design on the floor (or sidewalk, during recess). The player can move ahead or sideways, landing on 2 sections of his choice. He multiplies these 2 numbers and continues until he makes an error or reaches **out**.



3. things for each group: deck of playing cards

Remove all face cards. Change the aces to 1s and the jokers to 0s. The cards are shuffled and placed facedown in a stack. The first player draws 2 cards. If he can name the correct product for the 2 numbers shown, he keeps his cards. If the product is incorrect, the cards go to the bottom of the deck. Play continues until all cards are gone. The player with the most cards wins.

Variations:
1. Add the 2 numbers drawn.
2. Subtract the 2 numbers drawn.

additional learning aids

operation—chapter objectives 1, 2, 3, 4

SRA products

Computapes, SRA (1972)
Module 3, Lessons: MD 1, 2
diagnosis: an instructional aid—Mathematics Level A, SRA (1973)
Probe: L-12
Mathematics Involvement Program, SRA (1971)
Cards: 143, 14, 24, 64, 125, 275
Skill through Patterns, level 3, SRA (1974)
Spirit masters: 29, 30, 31, 32

other learning aids (described on page 72d)—Counting Chips, Cuisenaire rods, Lots-A-Links, Unifix Mathematics Classroom Kit

YOU REALLY NEED WORK ON YOUR TIMES-TABLES, SALLY, I CAN SEE THAT...
LET'S TRY THE THREES... HOW MUCH IS THREE TIMES FOUR?
FOUR THOUSAND? SIX? ELEVENTY TWELVE? FIFTY-QUILLION? OVERLY-EIGHT? TWIDDELY-TWO?
WELL? AM I GETTING CLOSER?
ACTUALLY, IT'S KIND OF HARD TO SAY!
SCHULZ

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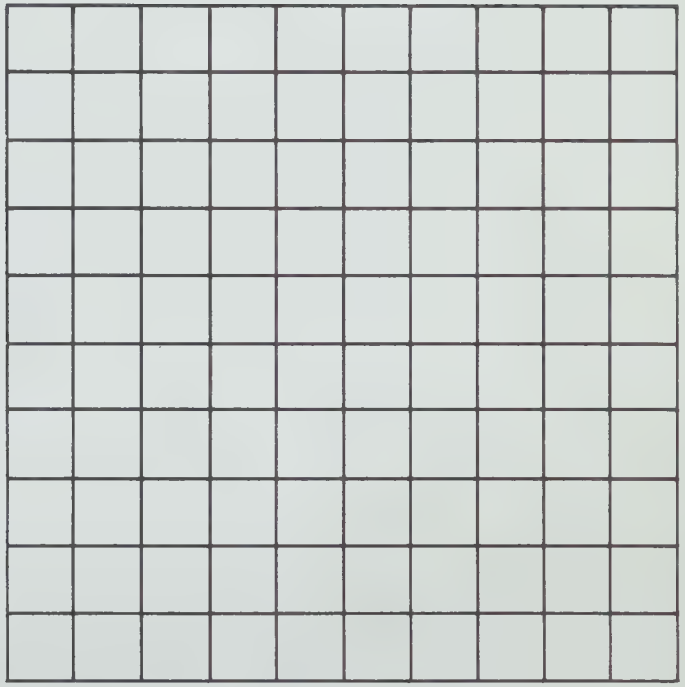
name _____

Color some arrays.

Write a multiplication sentence for each array.



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3 ADDITION

before this chapter the learner has—

1. Successfully compared any two numbers from 0 to 999
2. Read aloud or written any numeral from 0 through 999
3. Told how many hundreds, tens, and ones for any 3-digit number
4. Mastered adding any two 2-digit numbers with renaming

in chapter 3 the learner is—

1. Reading aloud and writing any numeral from 0 through 9999
2. Telling the value of each digit of a 4-digit number
3. Finding the sum of two 3-digit numbers
4. Finding the sum of three 3-digit numbers

in later chapters the learner will—

1. Master finding the sum of any two 3-digit numbers
2. Master finding the sum of any three 3-digit numbers
4. Master telling the value of each digit of a 4-digit number

Notes & Things

Many pupils will reach the year-end mastery objective for addition with the experiences in this chapter. Place-value study is extended to include hundreds as is the addition algorithm. It is quite possible that the pupils will not even notice that there is anything new in this chapter. That would be good.

Children are surprisingly well acquainted with large numbers. Sports broadcasts have introduced everyone to basketball scores greater than 100, for example. Newspaper ads proudly display in large type that a washing machine can be bought for as little as $149. More and more commercial games have scoring that can go higher than 100 points. It is not nearly as difficult to work with large numbers as it was to establish the "numberness" of a 3-digit number. As a result, the book has a minimum of the classic activities on place value. If you find that the children do need these experiences, please go back and use the techniques that you have found successful in the past. If you have liked working with bundles of 10 and bundles of 100 sticks, you certainly can use that technique again even though the book does not.

You will probably find that the simple algorithms for addition will turn some children into completely independent operators in addition. Maybe some of them, with just a bit of help, will be able to add not only 3-digit numbers but larger ones as well. If they don't make a generalization about addition, it's O.K. They will soon. And on the other end of the scale, you may find some children who still need more drill with the addition facts. This type of drill will be a top priority. Mom and dad, peers, and everyone else will have to get into this act and give daily help with the good, old-fashioned flash cards. All progress in addition is dependent upon accuracy and speed with the number facts. It's silly to pretend otherwise. And it is frustrating and a waste of time for all concerned to try to add other numbers until the facts are mastered. Goodness—that sounds like a pessimistic statement, doesn't it?

You will find that this chapter is a natural extension of the study started in chapter 1. There are no surprises. You will be pleased with the success that the children will have in the days to come.

things

spirit master of a 10-by-10 array of 2 cm squares
buttons or dried beans

For the extra activities you will want to have these things available:
wood cube
large- and small-square graph paper
egg cartons
rubber washers

goal Think about and explore ideas through a picture clue

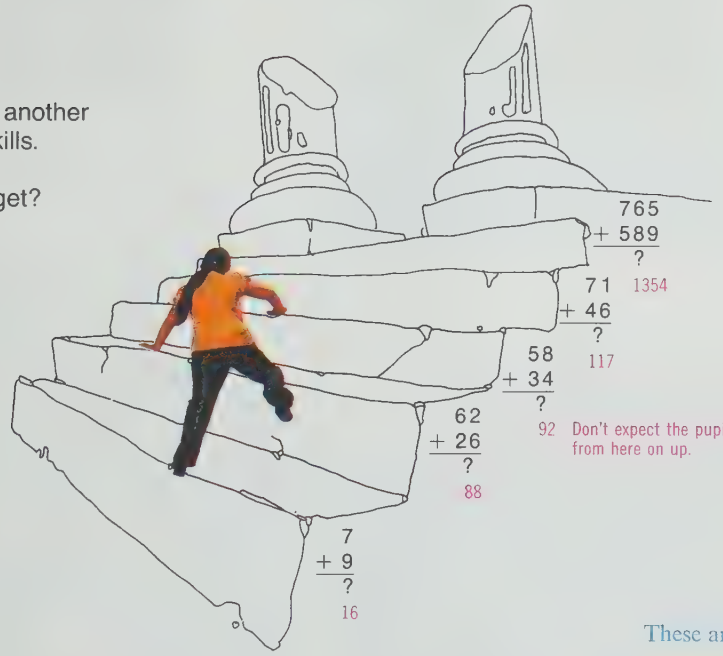
page 52 The photograph may show a familiar situation—a field trip. Start off getting the children to decide what is going on in the photograph. Their ideas may be much more fun to use than the field-trip theme.

Let them pretend that they are responsible for planning the outing, deciding where to go, how to go, how to keep track of people, what things would they see, how much time would be spent, what things would cost money, how to handle the money, and how to get people home again.

Keep a tally on the number of times good old-fashioned arithmetic would be used. The children may be surprised how many times their arithmetic skills are used, and you may be surprised at what good planners you have in your group.

Get ready to take another step in addition skills.

How far can you get?



765
+ 589
?
1354

71
+ 46
?
117

58
+ 34
?
92

62
+ 26
?
88

7
+ 9
?
16

Don't expect the pupils to answer from here on up.

These are *BIG* steps.

But you will get to the top!

Let that be YOUR GOAL

53

lesson Page 53

goal **Survey**—addition skills

page 53 The purpose of a survey page is to identify the pupils' learning goal for the chapter. No one should be upset because he can't compute every one of the steps now. The goal of this chapter is to develop these skills. Encourage the pupils who don't get up many of the steps. Assure them that they will be able to get a long way up as soon as they do the next pages.

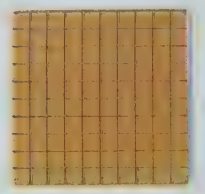
lesson Pages 54, 55, 56

goal Review of place value for 3-digit numbers

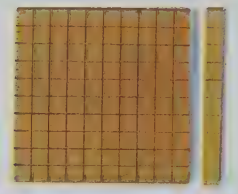
memo Skill with place value and renaming numbers is prerequisite to mastering addition and subtraction with renaming. Pages 54 through 59 are therefore essential for all pupils.

things spirit master: 10-by-10 array of 2 cm squares

page 54 This introduction has a lot of words. It needs your help so that the child can look at the arrays and not get hung up by the questions. Problem 4 should be independent work. Try a manipulative activity for anyone who needs help. Take a 10-by-10 array of 2 cm squares. Cut strips of 10 and single units as well. Leave some blocks of 100. Have the youngster **show** the hundreds, tens, and ones given and then **count** and **tell** how many. *How do you write that number?*

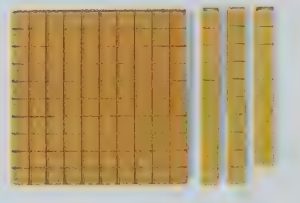


1. This is an array of 100.
   - **a** How many sets of 10 in this array? 10
   - **b** How many sets of 1 in this array? 100



2. This picture shows 110 squares.
   - **a** How many sets of 100 in the whole thing? 1
   - **b** How many sets of 10 in the whole thing? 11
   - **c** How many sets of 1 in the whole thing? 110
     The number 110 can have many names.

   But don't forget,
   110 means 1 hundred + 1 ten + 0 ones.



3. How many are shown here? 129
   - **a** How many sets of 100 in the whole thing? 1
   - **b** How many sets of 10 in the whole thing? 12
   - **c** How many sets of 1 in the whole thing? 129
     The number 129 can have many names.

   But don't forget,
   129 means 1 hundred + 2 tens + 9 ones.

4. Write the numeral for each.
   - **a** 3 hundreds + 2 tens + 8 ones 328
   - **b** 4 hundreds + 9 tens + 0 ones 490
   - **c** 9 hundreds + 5 tens + 7 ones 957
   - **d** 5 hundreds + 0 tens + 6 ones 506
   - **e** 2 hundreds + 2 tens + 2 ones 222
   - **f** 7 hundreds + 7 tens + 7 ones 777
   - **g** 0 hundreds + 1 ten + 0 ones 10
   - **h** 0 hundreds + 0 tens + 4 ones 4
   - **i** 8 hundreds + 0 tens + 0 ones 800

54

Pretend you have a job telling how many boxes of buttons can be packed. The buttons come to you in buckets. This bucket of 262 buttons has to be packed in boxes. The number in your bucket goes in the total column.

How many boxes of 100? 2
How many boxes of 10? 6
How many buttons left over? 2

Here come the buckets of buttons. Make a chart like this one. Complete it.

Total	Boxes of 100	Boxes of 10	Ones left over
262	2	6	2
511	? 5	? 1	? 1
27	? 0	? 2	? 7
399	? 3	? 9	? 9
407	? 4	? 0	? 7
100	? 1	? 0	? 0
450	? 4	? 5	? 0
999	? 9	? 9	? 9
1000	? 10	? 0	? 0

Your boss tells you to stop telling how many boxes of 100. Now your job is to make another chart and tell how many boxes of 10 can be packed. You still may have some left over.

Total	Boxes of 10	Ones left over
262	? 26	? 2
511	? 51	? 1
27	? 2	? 7
399	? 39	? 9
407	? 40	? 7
100	? 10	? 0
450	? 45	? 0
999	? 99	? 9
1000	? 100	? 0

goal Renaming 3-digit numbers as tens and ones

memo If you have bundles of 100 tongue depressors (or whatever) use them.

things buttons or dried beans

page 55 It might be fun to try a couple of examples for real. No buttons? Substitute dried beans. Buckets of brown beans should be just as much fun. But hopefully those 100 beans are in little plastic bags. Every group has a couple of willing helpers to get this job done. Then hope that none of the bags break.

Have the youngsters fold their paper into four columns to get the chart started. Then label as shown.

If anyone has trouble seeing the difference between the two exercises, try enacting one or two examples. Actually regroup 2 bags of 100 into bags of 10.

goal Exploring how place-value position changes the value of a digit

page 56 A good page for playacting. *I know which one I'd take. Do you? Why?* Listen for faulty reasoning. Listen for good arguments as well.

The word **digits** may be new or forgotten. Review that a digit is one of the numerals zero through nine. Ask the pupils to jot down answers for **3a** and **b.** Check for those who do not understand. You may want to expand this last activity into a little game. *Use only the digits 3 and 0. Write thirty. Now write three thousand.*

1. This bag of goodies goes to the person who asks for the most.

a I say I want all the sets of 100 I can get. How many sets of hundreds can I have? 3 sets

b He wants all the sets of 10 he can get. How many sets of tens can he have? 32 sets

c You want all the sets of 1 you can get. How many can you have? 325 sets

d Who gets the bag? You do (the person who wants sets of 1).

2. Let's change the rules. Now you take out the number you ask for when you ask for it. O.K.?

a You ask for the hundreds. How many do you get? 500

b She asks for the tens. How many does she get? 60

c I ask for the ones remaining. How many do I get? 4

d Who got the most this time? You did (the one who takes out hundreds—500—first).

3. All whole numbers can be written with these symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. These symbols are called digits. Look at how the value of a digit can change.

9	This 9 means 9 ones.
90	Here it means 9 tens.
900	Here it means 9 hundreds.
9000	Now it means 9 thousands.

a Use the digits 6 and 0 to write six hundred. 600

b Use the digits 2 and 0 to write two thousand. 2000

56

The numbers we use are neat. You can always depend upon their value.
They always have a special place saved for each digit.

1. We look at the number 524 and we know what it means.

		hundreds	tens	ones	Answers will vary. Examples:
a	524	5	2	4	But can it be renamed? Yes—52 tens 4 ones or 524 ones (It could be 4h, 12t, 4o, too.)
b	607	6	0	7	What could be another name? 60t, 7o
c	197	1	9	7	What could be another name? 19t, 7o
d	24	0	2	4	Does this have another name? 24o or 1t, 14o
e	970	9	7	0	Another name, please. 97t, 0o
f	500	5	0	0	Another name, please. 50t, 0o
g	1	0	0	1	Another name??? There isn't another whole-number name.

2. It's your turn now. Tell how many hundreds, how many tens, and how many ones.

a 461 — 4h, 6t, 1o
b 102 — 1h, 0t, 2o
c 350 — 3h, 5t, 0o
d 59 — 5t, 9o
e 875 — 8h, 7t, 5o
f 526 — 5h, 2t, 6o
g 70 — 7t, 0o
h 9 — 9o
i 200 — 2h, 0t, 0o

j Look back. Which number has the greatest number of hundreds? e(875)
Is that the largest number? Yes

3. Write how many tens and ones.

a 4 hundreds 2 tens 6 ones 42t, 6o
b 9 hundreds 8 tens 0 ones 98t, 0o
c 2 hundreds 0 tens 9 ones 20t, 9o
d 5 hundreds 0 tens 0 ones 50t, 0o
e 0 hundreds 9 tens 3 ones 9t, 3o
f 0 hundreds 5 tens 0 ones 5t, 0o
g 0 hundreds 1 ten 1 one 1t, 1o
h 1 hundred 0 tens 0 ones 10t, 0o

lesson Pages 57, 58, 59

goal Exploring the renaming of numbers

page 57 Have fun discussing problem 1. Many numbers should be read aloud so that the youngsters can hear **five hundred twenty-four.**

The pupils can run into trouble with the word **and.** It likes to slip in when numbers are being renamed to emphasize place value. In renaming 859, for example:

- eight hundred fifty-nine ones
- eighty-five tens and nine ones
- eight hundreds and fifty-nine ones

The word **and** should be saved to indicate a decimal. Please use the word **plus** to avoid confusion.

This book does not emphasize expanded notation; but if you have found it helpful, please use it in any way you wish in connection with place value.

Problems 2 and 3 should be done independently. Lined paper turned sideways will provide straight column guides. The pupil can write in the headings shown in the book.

goal Examining the renaming of thousands

page 58 Give names to the cartoon-character faces. Talk about this page. Have fun with it!

Talk about this.

1000

There was an argument.

says there is no such number. Is she right? No

says there are 10 hundreds, 0 tens, 0 ones.

says there are 100 tens and 0 ones. Who's right? Both are

says there is another way to name it.
1 thousand, 0 hundreds, 0 tens, 0 ones.
That's what 1 thousand means.
Can he be right? Yes

Your turn

1. How many ones make 1 thousand? 1000
2. How many tens make 1 thousand? 100
3. How many hundreds make 1 thousand? 10
4. Practice. Make a chart like this and complete it.

	thousands	hundreds	tens	ones
a 2000	? 2	? 0	? 0	? 0
b 4678	? 4	? 6	? 7	? 8
c 6701	? 6	? 7	? 0	? 1
d 1050	? 1	? 0	? 5	? 0
e 3005	? 3	? 0	? 0	? 5

Do you think you will ever add numbers as large as these?
Discuss. (In your future career?)

58

1. Write the greatest number of each pair.

a 1 or 10	**b** 10 or 100	**c** 100 or 1000
d 9 or 90	**e** 90 or 900	**f** 900 or 9000
g 423 or 324	**h** 509 or 905	**i** 601 or 610

2. Remember the symbol $>$? What does it stand for? Is greater than
What does the symbol $<$ mean? Is less than

3. Copy. Write $>$ or $<$ to show how the numbers relate to each other.

a 567 (?) 725 $<$	**b** 150 (?) 105 $>$	**c** 520 (?) 502 $>$
b 26 (?) 62 $<$	**e** 90 (?) 100 $<$	**f** 376 (?) 276 $>$
g 1000 (?) 2000 $<$	**h** 3000 (?) 2999 $>$	**i** 6000 (?) 5000 $>$

***4.** Let's pretend you want to buy a lot of things. You don't have much money. You decide to look in several stores to see where you can get the most for your money.

YOU WANT	STORE 1	STORE 2	STORE 3
tape for a recorder	69¢	89¢	94¢
a game to give as a present	75¢	73¢	79¢
bike wrench	39¢	40¢	35¢
comic book	25¢	28¢	29¢
gum	7¢ a pack	10¢ a pack	2 packs for 15¢

You have collected your information.
What is the "best buy"?
See number circled in each row above. Note "best buy" implies quality to some people, but quality is not a factor considered in the chart.

59

See activity 1, page 72a.

goal Comparing numbers

page 59 Make sure that the youngsters understand the directions. Then let them work problems 1 through 3 independently. You might have to refresh their memories on the relation symbols for **greater than** and **less than.**

Notice that problem 4 has been marked with an *. You may not want everyone to try this one. Sharing ideas about a comparative shopping venture could be an interesting discussion. It will depend on the maturity of the group. *Does the cheaper price always mean the best buy? Is quality as important as quantity?* The amount of money the buyer has available to spend must also be considered.

lesson Page 60

goal Diagnosis and review of simple addition skills

page 60 You may want to examine the order of the addends for pairs of addition facts and agree that these, for example, are the same fact:

$$\begin{array}{r} 9 \\ +1 \\ \hline \end{array} \qquad \begin{array}{r} 1 \\ +9 \\ \hline \end{array}$$

This is the commutative property for addition. Introduce the label if you want to, but it won't be used on the pupil page.

Use the folded-paper technique. Have the pupils record only the sums. Examine the results to identify those pupils who still have not mastered the basic addition facts and those who are not able to use these facts to add 2-digit multiples of 10.

If you add ones, is your answer less than 1 ten? Sometimes

9	8	7	6	5	4	3	2	1
+ 1	+ 2	+ 3	+ 4	+ 5	+ 6	+ 7	+ 8	+ 9
10	10	10	10	10	10	10	10	10

Find out

You added ones and got tens.
When you add ones, do you always get tens? No
Can your answer be less than 1 ten? Yes
Can it be more than 1 ten? Yes

	a	b	c	d	e	f	g	h	i
1.	2 + 9 = 11	8 + 4 = 12	8 + 5 = 13	7 + 4 = 11	7 + 5 = 12	5 + 3 = 8	5 + 6 = 11	3 + 7 = 10	6 + 2 = 8
2.	4 + 5 = 9	9 + 9 = 18	6 + 7 = 13	2 + 7 = 9	7 + 9 = 16	6 + 5 = 11	7 + 6 = 13	1 + 8 = 9	3 + 6 = 9

3. Look back. Is any answer more than 2 tens? No

Find out

If you add tens, can your answer be less than 1 ten? No
Can it be exactly 1 ten? Can it be less than 10 tens? No Yes
Can it be exactly 10 tens? Can it be more than 10 tens? Yes Yes

	a	b	c	d	e	f	g
4.	30 + 40 = 70	60 + 60 = 120	40 + 70 = 110	90 + 30 = 120	20 + 60 = 80	30 + 80 = 110	20 + 80 = 100
5.	90 + 20 = 110	80 + 90 = 170	60 + 40 = 100	50 + 90 = 140	70 + 30 = 100	70 + 70 = 140	40 + 90 = 130

6. Look at your answers. Is any answer more than 10 tens? Yes (4 b, c, d, f; 5 a, b, d, f, g)

60

Everyone wants to save paper. Why? This page might show you how to save writing space. Will that help save paper? Will it help save time? Yes

Find out

*Discuss. Paper is made from tree pulp. We want to save our trees.

REMEMBER THIS?

tens	ones	
4	7	
+ 3	8	
1	5	Add ones.
7		Add tens.
8	5	How many in all?

Look at another problem.
This one is written two ways.
How are the problems different?
First one has less writing, saves paper.
Same numbers? Yes
Same answer? Yes

Where did this come from?
Renaming 12 as 1 ten and 2 ones, then adding 1 ten to the other tens

t	o			t	o
1					
5	3			5	3
+ 2	9			+ 2	9
8	2	← Add ones.	→	1	2
		← Add tens.	→	7	
				8	2

Try saving space on these.

1. 41 + 39 = 80	2. 72 + 18 = 90	3. 63 + 27 = 90	4. 54 + 16 = 70	5. 45 + 39 = 84
6. 56 + 25 = 81	7. 57 + 37 = 94	8. 68 + 33 = 101	9. 73 + 27 = 100	10. 32 + 28 = 60

61

lesson Pages 61, 62, 63, 64

goal Introduction to the short algorithm for addition with renaming

page 61 Compare the two examples and have the pupils answer the questions. They should realize that it makes no difference whether the ten being renamed is shown at the top of the tens column or below the addends as they are added. You may need to give a few more examples.

goal Practice in adding two 2-digit numbers with renaming

page 62 Encourage the use of the short algorithm for computation. But remember—not everyone will be ready to use it yet.

You decide how to handle problems 14 through 17.

You can use the paper-saving form. Or use the other if you like it best.
Can you do these without any mistakes? Try it.

1. $\begin{array}{r} {\scriptstyle 1} \\ 25 \\ +\,58 \\ \hline 83 \end{array}$ ← Add ones. ← Add tens.

2. $\begin{array}{r} {\scriptstyle 1} \\ 36 \\ +\,49 \\ \hline 85 \end{array}$ ← Add ones. ← Add tens.

3. $\begin{array}{r} {\scriptstyle 1} \\ 47 \\ +\,23 \\ \hline 70 \end{array}$

4. $\begin{array}{r} {\scriptstyle 1} \\ 69 \\ +\,17 \\ \hline 86 \end{array}$

5. $\begin{array}{r} {\scriptstyle 1} \\ 28 \\ +\,39 \\ \hline 67 \end{array}$

6. $\begin{array}{r} {\scriptstyle 1} \\ 45 \\ +\,26 \\ \hline 71 \end{array}$

7. $\begin{array}{r} {\scriptstyle 1} \\ 78 \\ +\,13 \\ \hline 91 \end{array}$

8. $\begin{array}{r} {\scriptstyle 1} \\ 56 \\ +\,14 \\ \hline 70 \end{array}$

9. $\begin{array}{r} {\scriptstyle 1} \\ 73 \\ +\,28 \\ \hline 101 \end{array}$

10. $\begin{array}{r} {\scriptstyle 1} \\ 46 \\ +\,45 \\ \hline 91 \end{array}$

11. $\begin{array}{r} {\scriptstyle 1} \\ 27 \\ +\,64 \\ \hline 91 \end{array}$

12. $\begin{array}{r} {\scriptstyle 1} \\ 58 \\ +\,36 \\ \hline 94 \end{array}$

13. If you got one wrong, can you find the mistake?
If you got more than two wrong, what do you need to do?

PRACTICE some more. Review the addition facts; review the procedure for renaming numbers.

14. Bill was a clock watcher.
He practiced his music
24 minutes before school
and 36 minutes after school.
How long did he practice in all?
60 minutes (or 1 hour)

15. Sue was a clock watcher too.
She practiced her music
35 minutes before school
and 25 minutes after school.
How long did she practice in all?
60 minutes (or 1 hour)

16. Jake earned 65 cents one day.
He earned 25 cents another day.
Did he earn enough money
to buy a 90-cent model car?
Yes (as long as there's no sales tax)

17. June earned 45 cents one day.
She earned 50 cents another day.
Did she earn enough money
to buy a 79-cent book? Yes

62

Remember this?
It's the paper-saving form for addition.

	t	o
	1	
	5	7
+	2	9
	8	6

← Add the ones.
← Add the tens.

Somebody made a lot of mistakes on this page. He did the problems as shown in the example above, but every answer except one is wrong. Look for the mistakes. Copy the problems. Show how to do them right.

1. $\begin{array}{r} {\scriptstyle 1}\,5\,2 \\ +\,2\,9 \\ \hline 8\,0 \end{array}$ $\begin{array}{r} 5\,2 \\ +\,2\,9 \\ \hline 8\,1 \end{array}$

2. $\begin{array}{r} 6\,3 \\ +\,3\,7 \\ \hline 9\,0 \end{array}$ $\begin{array}{r} {\scriptstyle 1\,1}\,6\,3 \\ +\,3\,7 \\ \hline 10\,0 \end{array}$

3. $\begin{array}{r} {\scriptstyle 1}\,2\,6 \\ +\,6\,9 \\ \hline 9\,4 \end{array}$ $\begin{array}{r} {\scriptstyle 1\,1}\,2\,6 \\ +\,6\,9 \\ \hline 9\,5 \end{array}$

4. $\begin{array}{r} {\scriptstyle 2}\,4\,5 \\ +\,3\,7 \\ \hline 9\,1 \end{array}$ $\begin{array}{r} {\scriptstyle 1\,1}\,4\,5 \\ +\,3\,7 \\ \hline 8\,2 \end{array}$

5. $\begin{array}{r} {\scriptstyle 1}\,6\,2 \\ +\,2\,5 \\ \hline 9\,7 \end{array}$ $\begin{array}{r} 6\,2 \\ -\,2\,5 \\ \hline 8\,7 \end{array}$

6. $\begin{array}{r} {\scriptstyle 1}\,7\,7 \\ +\,1\,7 \\ \hline 9\,6 \end{array}$ $\begin{array}{r} {\scriptstyle 1\,1}\,7\,7 \\ +\,1\,7 \\ \hline 9\,4 \end{array}$

7. $\begin{array}{r} {\scriptstyle 1}\,3\,6 \\ +\,2\,9 \\ \hline 6\,5 \end{array}$ right

8. $\begin{array}{r} {\scriptstyle 2}\,4\,8 \\ +\,4\,4 \\ \hline 10\,1 \end{array}$ $\begin{array}{r} {\scriptstyle 1\,1}\,4\,8 \\ +\,4\,4 \\ \hline 9\,2 \end{array}$

Talk about these.

9. What mistake was made on problem 4? problem 8? 12 ones was renamed as 2 tens and 1 one.
Does any addition fact have an answer greater than 18? No (9 + 9 = 18 has largest numbers.)

10. What mistake was made on
problem 1? problem 3? problem 6? The ones were incorrectly added.
What can a person do about mistakes like these? PRACTICE some more.

11. What mistake was made on problem 5? He renamed 7 ones as 1 ten and 7 ones.

12. What mistake was made on problem 2? He renamed 10 ones as 0 ones.
He probably just forgot to write
the 1 with the other tens.

63

See activity 2, set A, page 72a.

See activity 3, page 72a.

goal **Progress Check**—adding two 2-digit numbers with renaming

memo Only the problems on the reproduced child's paper can be considered the Progress Check. These problems should be copied and reworked.

page 63 A good way to help pupils become aware of their own mistakes is to have them help find the mistakes of others. Discuss the goal for the problems on the child's paper. Find the errors and correct the problems independently. The results will help you identify those pupils who have mastered the addition of two 2-digit numbers and those who need more help. If oodles of errors are discouraging you, think what the poor child feels like. This may be a time to ask mom or dad to help.

You'll want to discuss the questions as a group. Let this be their thinking. Guide, but don't tell. Do not expect every pupil to analyze the mistakes. This is difficult for many adults.

goal Practice in adding two 2-digit numbers

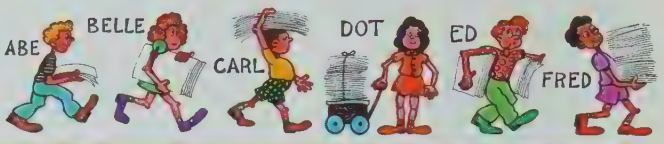
page 64 Since this is practice, use the opportunity to give additional help to any who are insecure, while the others work independently.

1. Free-throw contest. Two rounds.
Two best scorers go to finals.
Which two will go to the finals?
2 and 4 (Both had scores totaling 44.)

30 shots each round

Scores						
	Round 1	25	19	24	29	21
	Round 2	17	25	16	15	19
		42	44	40	44	40

2. Paper drive. Two days.
Bring all you can carry.
Who brought the least? Abe



1st day	25	36	44	50	38	29
2nd day	37	29	28	26	25	37
	62	65	72	76	63	66

Here's a challenge. Can you find how much in all? 404

3. The packing boxes hold 100 cartons. Each box is partly full.

Already in box	25	25	25	25	25	25
Add this many more	57	68	85	59	76	74
	82	93	110	84	101	99

How many have more than 100? 2 (the third and fifth boxes from the left)

64

7 5

How many tens in 70? How many tens in 50?
How many tens in 70 and 50 together? 12

tens | ones

$$\begin{array}{r} 70 \\ +\ 50 \\ \hline 120 \end{array}$$

1

How many hundreds in 120? Is this right? Yes →

$$\begin{array}{r} 70 \\ +\ 50 \\ \hline 120 \end{array}$$

YOU TRY IT

$$\begin{array}{r} 90 \\ +\ 80 \\ \hline 170 \end{array} \qquad \begin{array}{r} 60 \\ +\ 70 \\ \hline 130 \end{array} \qquad \begin{array}{r} 65 \\ +\ 71 \\ \hline 136 \end{array} \qquad \begin{array}{r} 54 \\ +\ 61 \\ \hline 115 \end{array}$$

1. Save some writing time. Use h for hundreds, t for tens, and o for ones.

a $\begin{array}{r} 90 \\ +\ 20 \\ \hline 110 \end{array}$ **b** $\begin{array}{r} 80 \\ +\ 50 \\ \hline 130 \end{array}$ **c** $\begin{array}{r} 70 \\ +\ 80 \\ \hline 150 \end{array}$ **d** $\begin{array}{r} 50 \\ +\ 60 \\ \hline 110 \end{array}$ **e** $\begin{array}{r} 70 \\ +\ 30 \\ \hline 100 \end{array}$

2. Now see if you can add tens and ones.

a $\begin{array}{r} 68 \\ +\ 81 \\ \hline 149 \end{array}$ **b** $\begin{array}{r} 84 \\ +\ 75 \\ \hline 159 \end{array}$ **c** $\begin{array}{r} 93 \\ +\ 53 \\ \hline 146 \end{array}$ **d** $\begin{array}{r} 71 \\ +\ 48 \\ \hline 119 \end{array}$ **e** $\begin{array}{r} 65 \\ +\ 64 \\ \hline 129 \end{array}$

lesson Pages 65, 66, 67, 68, 69

goal Adding tens with a sum greater than a hundred

memo Page 65 begins the sequence of development for adding 3-digit numbers with renaming. The lessons will be moving in ministeps. Success at each step is important to reaching the goal.

warm-up Write $\begin{array}{r} 7 \\ +5 \end{array}$ on the board. Have a volunteer write the answer. Next, put some zeros behind the 7 and 5 to make them 70 and 50. *Is 12 still the answer? Can someone change the answer to make it correct?* Try another example or two.

page 65 Watch out for troubles as the youngsters complete the first row independently. Clear up any trouble before going on.

Examine the next row. *How are these problems different from the others?* (The digit in the ones place is not 0.) This shouldn't cause a problem. Let everyone show you how smart he is as the page is completed.

goal Adding a 3-digit number and a 2-digit number with renaming

page 66 The example provides the model for the page. Note that each row of problems has a slightly different skill. You are the best judge of how to handle the remainder of the page.

One more time. This time add hundreds, too. This won't be hard.

hundreds	tens	ones	
2	5	6	
+	4	2	
2	9	8	Add ones.
			Add tens.
			Add hundreds.

Ooops! No hundreds to add to the two hundreds.
But don't forget about the hundreds that are there.

You do these.

	h	t	o		h	t	o		h	t	o		h	t	o		h	t	o		h	t	o
1.	3	4	7	**2.**	5	2	9	**3.**	6	0	8	**4.**	8	1	3	**5.**	4	3	5	**6.**	2	6	0
+		3	1	+		7	0	+		9	1	+		5	6	+		6	4	+		2	8
	3	7	8		5	9	9		6	9	9		8	6	9		4	9	9		2	8	8

You did not have to rename the ones in the last row.
You will rename ones in this row.

	h	t	o		h	t	o		h	t	o		h	t	o		h	t	o		h	t	o
		1				1				1				1				1				1	
7.	4	3	6	**8.**	2	5	8	**9.**	5	2	7	**10.**	3	1	4	**11.**	6	7	4	**12.**	7	0	3
+		1	6	+		2	4	+		6	5	+		7	9	+		1	7	+		5	8
	4	5	2		2	8	2		5	9	2		3	9	3		6	9	1		7	6	1

You will rename tens in this row. Look out!

	h	t	o		h	t	o		h	t	o		h	t	o		h	t	o		h	t	o
	1				1				1				1				1				1		
13.	1	8	4	**14.**	1	9	5	**15.**	6	7	3	**16.**	8	2	2	**17.**	5	6	7	**18.**	3	5	6
+		6	2	+		2	3	+		7	3	+		8	7	+		5	2	+		9	1
	2	4	6		2	1	8		7	4	6		9	0	9		6	1	9		4	4	7

66

What happens now?

You know this → 6 + 9 = 15

And this → t o: 1 / 5 6 + 9 = 65

And this → h t o: 1 1 / 5 6 + 7 9 = 135

And this → h t o: 1 / 1 6 2 + 8 1 = 243

Try this

Use the paper-saving form.

h t o: 1 1 / 1 5 6 + 1 7 9 = 3 ■ 35

First add the ones.
Then add the tens.
Finish by adding the hundreds.

Practice some by yourself.

1. h t o: 1 1 / 1 3 5 + 7 8 = 213
2. h t o: 1 1 / 2 5 9 + 6 4 = 323
3. h t o: 1 1 / 1 7 9 + 3 5 = 214
4. h t o: 1 1 / 3 4 6 + 6 5 = 411
5. h t o: 1 1 / 5 8 5 + 7 7 = 662
6. h t o: 1 1 / 1 6 7 + 6 9 = 236
7. h t o: 1 / 4 3 5 + 9 2 = 527
8. h t o: 1 / 3 4 5 + 7 0 = 415
9. h t o: 1 / 1 8 3 + 8 2 = 265
10. h t o: 1 / 2 7 4 + 7 4 = 348
11. h t o: 1 / 4 9 3 + 6 5 = 558
12. h t o: 1 / 5 7 2 + 6 7 = 639

13. There were 564 adults' tickets sold. There were 95 children's tickets sold. How many tickets were sold in all? 659

14. There was room for 625 to sit on chairs. 75 more could sit on benches. How many people could be seated? 700

67

goal Renaming twice in addition

page 67 We've reached the top step of the addition skill climb. The example at the top of the page is important. Talk about it.

Check on success with the first four problems. Work with youngsters who need help now. This will prevent a lot of trouble later. It shouldn't take long to get things straightened out. Gently nag if necessary to encourage the child to do one thing at a time. *First add the ones. Then add the tens. Finish by adding the hundreds.* The remainder of the page should be completed independently.

goal **Progress Check**—adding 3-digit numbers with renaming

page 68 The example should get everyone started. Work problems 1 and 2 with the children, encouraging the paper-saving form.

Use problems 3 through 12 as a Progress Check. You will be able to identify those pupils who can operate independently. Let them help you help the others. Success and a feeling of confidence are very important now.

Now you can do this too.

Here's the longer form.

h	t	o	
	3	4	8
+ 1	9	4	
	1	2	Add ones.
1	3		Add tens.
4			Add hundreds.
5	4	2	In all

Here's the paper-saving form.

h	t	o	
1	1		
	3	4	8
+ 1	9	4	
5	4	2	← Add ones.
	↑		Add tens.
↑			Add hundreds.

Try the paper-saving form to add these if you can.

1.

h	t	o	
1	1		
	7	4	4
+ 1	9	8	
9	4	2	← Add ones.
	↑		Add tens.
↑			Add hundreds.

2.

h	t	o	
1	1		
	5	3	8
+ 3	7	6	
9	1	4	← Add ones.
	↑		Add tens.
↑			Add hundreds.

3.

h	t	o
1	1	
4	5	4
+ 4	8	7
9	4	1

4.

h	t	o
1		
6	9	0
+ 1	4	0
8	3	0

5.

h	t	o
1	1	
5	8	3
+ 1	7	9
7	6	2

6.

h	t	o
1		
4	2	8
+ 2	8	1
7	0	9

7.

h	t	o
	1	1
3	5	9
+ 2	7	8
6	3	7

8.

h	t	o
1	1	
4	4	4
+ 1	6	7
6	1	1

9.

h	t	o
	1	
7	0	5
+ 1	2	8
8	3	3

10.

h	t	o
1	1	
4	5	5
+ 1	5	6
6	1	1

11.

h	t	o
1	1	
2	4	8
+ 1	6	2
4	1	0

12.

h	t	o
	1	1
4	3	7
+ 3	6	3
8	0	0

Are you making progress? Don't forget to ask for help if you need it.

68

See activity 2, set B, page 72a.

See activity 4, page 72b.

There really aren't many rules in addition. You have to know the addition facts.
You have to know the value of each digit.
Then you add.

h	t	o	
1	3	5	
+	5	7	
192	?	?	? ← First add the ones.
			← Then add the tens.
			← And then add the hundreds.

1.

h	t	o	
1			
3	6	2	
+ 1	4	7	
5	0	9	← Add ones.
			← Add tens.
			← Add hundreds.

2.

h	t	o	
1	1		
5	6	8	
+	5	3	
6	2	1	← Add ones.
			← Add tens.
			← Add hundreds.

3.

h	t	o	
1	1		
2	3	8	
+ 1	9	7	
4	3	5	← Add ones.
			← Add tens.
			← Add hundreds.

4. Have you ever been bowling? Some kids we know went the other day. They each rolled two games.
Who had the highest score? Sally

	Tom	Dick	Harry	June	Sally
Game 1	125	67	100	97	105
Game 2	78	49	110	39	109
	203	116	210	136	214

5. Some big brothers and sisters went along too.
Who had high score? Harry's brother

	Tom's sister	Dick's brother	Harry's brother	June's sister	Sally's brother
Game 1	169	181	225	105	125
Game 2	173	149	178	125	173
	342	330	403	230	298

goal Practice with short algorithm for adding 3-digit numbers

memo Look out for children who know nothing about bowling. The word problems won't make sense if they don't know what the game is.

page 69 Use this practice page to meet the needs of your ability groups. Independent learners should go directly to problems 4 and 5. Review the computation model at the top of the page with the others and use the word problems as small-group projects.

Problem 5 shouldn't be done by children who are having real trouble. You may want to have them do it at another time when they've gained more confidence.

lesson Pages 70, 71

goal Adding three 2- or 3-digit numbers with renaming

page 70 Independent learners can complete the pet-shop inventory on their own. Encourage pupils who do not need to show the renaming step to use mental arithmetic and record the answer only.

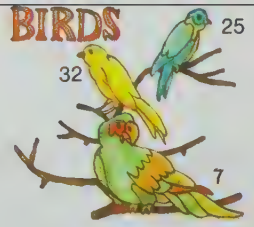
Check the progress of those who have been having trouble. Note that the problems increase in level of difficulty. How far can they succeed independently? Be ready to help if necessary.

It was a great pet shop. It had everything.
The owner had to count how many things she had. Please help.

1 How many dogs in all? 35

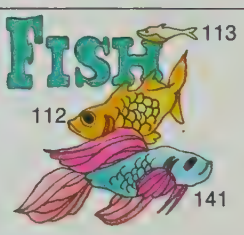
2 How many cats in all? 45

3 How many toys in all? 135



4 How many birds in all? 64

5 How many animals in all? 121



6 How many fish in all? 366

7 How many boxes in all? 498

8 How many cans in all? 443

9 How many cans in all? 507

70

SHOW HOW GOOD YOU ARE

1 Add 23 to each of these numbers.

a	b	c	d	e	f
32	43	54	65	76	87
55	66	77	88	99	110

2 Add 65 to each of these numbers.

a	b	c	d	e	f
22	33	44	55	66	77
87	98	109	120	131	142

3 Add 34 to each of these numbers.

a	b	c	d	e	f
12	24	48	96	192	384
46	58	82	130	226	418

4 Add 99 to each of these numbers.

a	b	c	d	e	f
1	10	11	100	101	111
100	109	110	199	200	210

5 Add 111 to each of these numbers.

a	b	c	d	e	f
123	345	567	789	899	999
234	456	678	900	1010	1110

Here is something extra. Try it if you have time.

ADD

6
$$\begin{array}{r} 23 \\ 14 \\ +\ 32 \\ \hline 69 \end{array}$$

7
$$\begin{array}{r} 16 \\ 42 \\ +\ 21 \\ \hline 79 \end{array}$$

8
$$\begin{array}{r} 25 \\ 15 \\ +\ 52 \\ \hline 92 \end{array}$$

9
$$\begin{array}{r} 142 \\ 235 \\ +\ 322 \\ \hline 699 \end{array}$$

10
$$\begin{array}{r} 561 \\ 215 \\ +\ 120 \\ \hline 896 \end{array}$$

11
$$\begin{array}{r} 436 \\ 354 \\ +\ 206 \\ \hline 996 \end{array}$$

71

goal Practice with addition with renaming

page 71 Examine the problems carefully. Note the different types of practice that are provided.

- Adding two 2-digit numbers
- Adding a 2-digit number and a 3-digit number
- Adding two 3-digit numbers
- Adding three 2-digit numbers
- Adding three 3-digit numbers

You may want your pupils to complete one of each type and then practice only the type that is still troublesome.

Use these problems in the way that best meets the needs of your pupils before the Checkout on page 72.

lesson Page 72

goal **Checkout**—adding 2- and 3-digit numbers with renaming

page 72 This Checkout is organized so that you can quickly identify any individual problems. The specific skills are listed on the answer key. There are a lot of problems to do. Allow enough time. There is no renaming in the first three rows; so have the pupils record the answers only. Most pupils will probably need to copy the rest of the problems.

If a child makes errors in the first three rows, he does not yet know the addition facts. (The child will be as discouraged as you are in this event.) Errors only in the last two rows probably mean trouble with renaming. You will need to take time with each pupil. Work with problems such as 74 + 38, 246 + 34, and 63 + 37 and ask the pupil to think aloud as he completes them. You will spot the errors in thinking in no time at all. Then you will be able to give appropriate practice and support.

CHECKOUT

Keep on using the longer form of addition if you want to.
You can save paper in other ways.

You have a goal.
You're going to get good at adding any two numbers.
Have you reached that goal yet? Prove it. Do these steps.

1. First step Skill: Addition facts.

a	b	c	d	e	f
8	4	7	9	6	8
+ 7	+ 7	+ 0	+ 5	+ 9	+ 3
15	11	7	14	15	11

2. Second step Skill: Adding tens

70	60	40	50	90	80
+ 20	+ 30	+ 40	+ 20	+ 20	+ 40
90	90	80	70	110	120

3. Third step Skill: Adding tens and ones, no renaming

56	28	39	52	61	46
+ 20	+ 50	+ 40	+ 25	+ 26	+ 53
76	78	79	77	87	99

4. Fourth step Skill: Adding tens and ones, renaming ones

24	47	35	56	34	69
+ 28	+ 29	+ 28	+ 56	+ 87	+ 45
52	76	63	112	121	114

5. Fifth step Skill: Adding ones, tens, and hundreds, renaming ones and tens

a 128 + 146 = 274

b 568 + 83 = 651

c 377 + 249 = 626

d Make up three more problems. Then find the answers too.

72

See activities 5 and 6, page 72b.

See activity 7, page 72c.

RESOURCES

another form of evaluation

for Progress Check—page 63
Add.

1.	2.	3.	4.
18	36	47	69
+ 49	+ 24	+ 36	+ 15
67	60	83	84

Three of these problems have mistakes. Look for the mistakes. Then show how to make the problems right.

5.	6.	7.	8.
28	34	49	25
+ 37	+ 57	+ 23	+ 28
55	91	81	54
28	right	49	25
+ 37		+ 23	+ 28
65		72	53

for Progress Check—page 68
Add. Use the paper-saving form if you can.

1.	2.	3.	4.
236	485	658	349
+ 478	+ 393	+ 297	+ 393
714	878	955	742

5.	6.	7.	8.
748	570	487	265
+ 155	+ 260	+ 264	+ 265
903	830	751	530

for Checkout—page 72
Remember your goal? You want to be good at addition. Keep on using the longer form of addition if you wish. See if you've reached your goal now. Do these steps.

1. First step

a)	b)	c)	d)	e)	f)
9	5	0	7	7	2
+ 7	+ 8	+ 8	+ 8	+ 4	+ 9
16	13	8	15	11	11

2. Second step

a)	b)	c)	d)	e)	f)
50	40	30	60	60	30
+ 30	+ 50	+ 40	+ 20	+ 90	+ 80
80	90	70	80	150	110

3. Third step

a)	b)	c)	d)	e)	f)
37	49	26	71	62	76
+ 60	+ 40	+ 50	+ 18	+ 33	+ 21
97	89	76	89	95	97

4. Fourth step

a)	b)	c)	d)	e)	f)
38	27	36	68	94	87
+ 25	+ 29	+ 47	+ 48	+ 57	+ 37
63	56	83	116	151	124

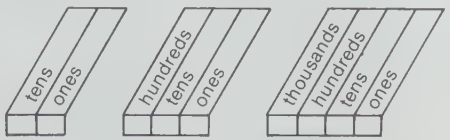
5. Fifth step

a)	b)	c)
1129	3284	3847
+ 1169	+ 96	+ 357
2298	4284	7411

activities

1. things spirit master, small box, numeral cards 0 through 9

The spirit master should have 3 place-value charts in columns, as shown, to provide different types of practice.



Give each pupil a copy of the place-value charts. Mix the numeral cards in the small box. First the group must decide whether to build a 2-, 3-, or 4-digit numeral and identify the appropriate chart to use. Then a card is drawn from the box and the digit read to the group. The pupils write this digit in any one of the positions of the chart previously selected. Repeat the drawing until a digit has been drawn and read for each position—two for a 2-digit numeral, three for a 3-digit numeral, and so on. Have a pupil read the number he wrote. *Did anyone write a different number? Who wrote the greatest number? the least number?*

For variety replace the card after it has been read. This digit can then occur more than once.

2. Check the youngster's ability to recognize when renaming is necessary. These two sets of problems suggest a spirit master. After copies have been made, cut the sets apart to meet individual practice needs.

Set A Ring the columns of numbers that require renaming. Do not add.

35	71	55	47
+ 46	+ 23	+ 62	+ 74
30	64	81	22
+ 85	+ 29	+ 32	+ 29

Set B Ring the columns of numbers that require renaming. Do not add.

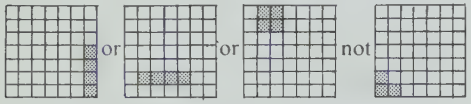
329	470	520
+ 246	+ 253	+ 291
756	421	506
+ 198	+ 326	+ 285

3. things felt pen, wood cube, large-square graph paper; for each player: small-square graph paper, colored pencils or crayons

Cut a 10-by-10 grid from large-square graph paper for a game board. You may want to paste this grid on cardboard. With a felt pen, write an addition fact in each square of the

grid. No answers, please. Have each player outline a 7-by-7 grid on his graph paper.

To begin play, a player rolls a cube onto the game board. He names the sum for the fact on which the cube landed. He then colors on his grid the same number of squares as in the sum; the colored squares, however, must form a rectangle.



Rules:

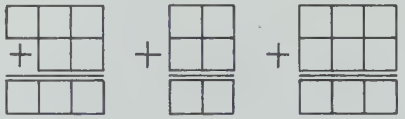
- If the cube lands off the game board of if it lands on more than 1 square, the player rolls again.
- Players take turns. The squares colored in any turn must always form a rectangle.
- If a player can't find squares that form a rectangle and also equal in number the missing sum, he must pass his turn without coloring any squares.
- If a player is challenged for coloring the wrong number of squares or squares that do not form a rectangle, he must outline these squares in a darker color. These squares are then treated as though they were not yet colored and can be used later in the game. The player's turn passes.
- The winner is the first player to color all his squares.

Variations:

1. Adapt for practice with the subtraction facts by preparing a similar game board showing subtraction facts.
2. Prepare a game board showing missing-factor sentences. For example: $\_ \times 6 = 54$; $3 \times \_ = 15$. Multiplication facts are not appropriate since the products are too large to color on the grid.
3. Prepare a game board showing division facts.

4. things for each pair of players: 40 one-inch cardboard squares, shirt cardboard, felt pen

Use the shirt cardboard to prepare a game board as shown. Make the squares at least 1 inch in size.



Prepare playing tiles by numbering the cardboard squares 0 through 9—4 tiles for each number, 40 tiles in all.

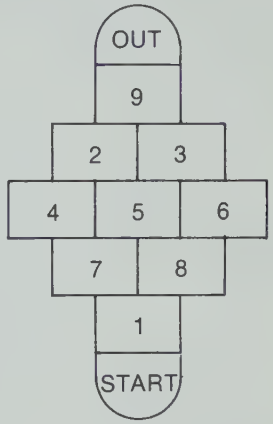
The tiles are mixed and spread facedown on the table. The players alternate choosing a tile, turning it faceup, and placing it on one of the empty squares on the game board. The goal is to form a completed addition problem in each set of squares on the board.

Rules:

- If a player cannot use the tile he chooses to add correctly, he places the tile faceup in front of him. If he can use it later, he may play this tile rather than choose another facedown tile.
- If a player is challenged for playing a tile and adding incorrectly, he removes the tile from the board, places it faceup before him, and his turn passes. This tile may be used correctly on a later turn. The player also loses 2 points for this error.
- When a player plays his last tile and completes 1 of the 3 possible problems, he scores 10 points.
- 30 points are possible in completing the 3 problems that make a round. A round ends when all problems are completed or when all the tiles have been drawn and further play is impossible.
- At the end of a round each player loses 1 point for each faceup tile in front of him.
- The winner is the first player to have at least 30 points. If both players have over 30 points at the end of a round, the one with the greater score wins.

5. things hopscotch design

Draw or tape a hopscotch design on the floor (or sidewalk, during recess). The player can move ahead or sideways, landing on 2 sections of his choice. He adds these 2 numbers and continues until he makes an error or reaches **out**.



Variation:

1. The player subtracts to find the difference of the 2 numbers.

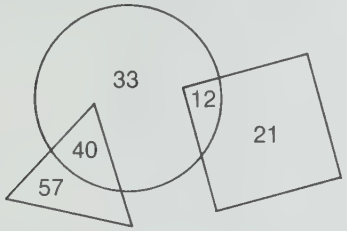
6. things for each group: egg carton, crayon 2 rubber washers

Group pupils who need similar practice. Have the children write numerals in the cups of the egg carton. Specify a range of numbers for them to choose from—multiples of 10, any 2-digit number, any 3-digit number, or any number less than 1000. This will provide each group with the practice needed.

In turn, each person tosses the rubber washers into the cups one at a time. The youngster then adds to find the sum. This sum is his score. Winner of the round can be the person with the highest score **or** with the lowest score —whichever the group predetermines.

7. things spirit master of geometric figures

Each youngster picks his own numbers to write inside the figures. For example:



Add the numbers—

a inside the circle
b inside the square
c inside the circle and the triangle
d inside the circle, but not inside the square
e that are not in the square
f inside the square and inside the triangle

Be sure to leave space below each direction for computation.

additional learning aids

notation—chapter objectives 1, 2

SRA products

diagnosis: an instructional aid—Mathematics Level A, SRA (1973)
Probes: L-6, 8

Mathematics Involvement Program, SRA (1971)
Cards: 262, 114

Visual Approach to Mathematics, level 3, SRA (1967)
Visual: 3

other learning aids (described on page 72d)—Chip Trading, Flip-A-Strip Place Value Chart, Unifix Mathematics Classroom Kit

operation—chapter objectives 3, 4

SRA products

Computapes, SRA (1972)
Module 1, Lesson: AS 7
Module 2, Lessons: AS 26, 27, 30, 31

Cross-Number Puzzles (Whole Numbers), SRA (1966)
Addition cards: 2, 3, 7, 12

Mathematics Involvement Program, SRA (1971)
Cards: 353, 155

Skill through Patterns, level 3, SRA (1974)
Spirit masters: 8, 9, 12, 15, 16, 17, 19, 23, 24, 25, 26, 35

Visual Approach to Mathematics, level 3, SRA (1967)
Visuals: 8, 9, 10

other learning aids—Calculator, Checkermatics, Ting, Veri-Tech Senior (multiplication book)

Other Learning Aids

whole-number concepts

Abacus board (Creative Publications) Counting board useful for teaching place value
Abacus Spinner Game (Math Shop) Game for recognition and understanding of place value
Chip Trading (Scott Scientific) Several games that develop understanding of place value
Flip-A-Strip Place Value Chart (Developmental Learning Materials) Easel board chart to provide practice with place value and whole-number operations
Place Value I and II (Math Shop) Self-correcting cards to provide practice in reading of numbers through hundred millions

whole-number operations

Calculator (Sigma Scientific) Four place-value calculator for addition and subtraction
Checkermatics (SEE) [level 1] A game for reinforcement and enrichment in whole-number skills
Counting chips (Creative Publications) Plastic disks of eight colors
Cuisenaire Rods® (Cuisenaire) Centimetre rods that provide a concrete approach to developing operations
Dividing Machine (DLM) Device to reinforce basic division facts
Fact-O (Math Shop) Activities for addition and subtraction facts
I Win (Scott, Foresman) [sets 1 and 2] Cards to provide practice in four basic operations
Lots-A-Links (Creative Publications) Plastic links that snap together for counting activities
Mathematical Balance (Mind/Matter) Plastic balance and weights to show relationships between addition and subtraction
Mathfacts Games™ (Milton Bradley) [levels 3–5] Self-instructional and self-checking games that deal with the basic facts
Multifax & Quotient (Math Shop) Games in which number sentences are formed
Multiplying Machine (Math Shop) Self-checking machine used to practice the facts
Orbiting the Earth (Scott, Foresman) [addition and subtraction] Game with vinyl playing field for fact practice
Quizmo (Milton Bradley) Lotto-type game that reinforces basic skills with whole numbers
Stamina (Creative Publications) Spinner game providing practice with whole-number operations
Tally and Difference (Creative Publications) Games in which the addition and subtraction facts are used to form number sentences
Unifix Mathematics Classroom Kit (ETA) Set of interlocking cubes that develop understanding of the whole-number operations
Veri-Tech Senior (ETA) [addition, subtraction, and multiplication books] A self-checking device that provides practice with whole-number operations
Winning Touch (Ideal) A game for multiplication facts

fractional-number concepts

Action Fraction Games (Constructive Playthings) Games to develop concepts and skill with fractions
Fraction Bars Student Activity Book (Creative Publications) Games and activities to teach specific objectives for fractions
Fraction Dominoes (SEE) Game involving matching a fractional numeral with its model
Fraction Inlay Boards (General Learning Corp.) Fractional parts of circles or squares
Fraction Line Set (Sigma Scientific) An activity to help visualize operations by computing with fraction strips

geometry

Geoboard Activity Cards (Creative Publications) [primary and intermediate sets] Geoboard activities that lead pupils to explore, compare, and make shapes
Geoboard Kit (Cuisenaire) Plastic geoboards and related activity cards that show basic geometric concepts
Learn to Fold—Fold to Learn (Lyons & Carnahan) Workbook that presents a variety of activities to demonstrate symmetry
Metric Primary Shapes (Invicta) Basic geometric shapes and work cards that reinforce identification skills
Mira (Creative Publications) An aid for investigating properties of plane geometry
Mira Math for Elementary School (Creative Publications) Series of activities to be used with the mira
Paper and Pencil Geometry (Lyons & Carnahan) A geometry book that provides activities to develop basic geometric concepts
Pattern Blocks and Mirrors (Math Shop) Colored blocks used to investigate geometric figures and mirror reflections
Tangrams (Creative Publications) A 7-piece puzzle to be used with tangram shapes
Tangramath (Creative Publications) Book to be used with tangram pieces for exploring concepts of shape, congruence, similarity, and area

measurement

Equal Pan Scales (ESA) Pan balance designed to develop weighing techniques
Judy Clock (General Learning) Movable hands and visible functioning gears to provide learning experiences in telling time
Learning about Measurement (Lyons & Carnahan) A workbook for customary and metric measurement activities
Linear Measures (DLM) A series of linear measuring activities using the customary system
Making and Using Graphs and Nomographs (Lyons & Carnahan) A workbook that develops concepts and skill in the making and reading of graphs
Metric Trundle Wheel (Invicta) Wheel designed to introduce concepts of linear measurement
100 g Balance (ESA) A plastic balance for weighing masses of between 1 gram and 100 grams
Tell-Time Quizmo (Milton Bradley) A lotto-type game to stimulate interests in telling time

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RE

		METRIC	
	foot	10 millimetres (mm)	= 1 centimetre
	yard	10 centimetres (cm)	= 1 decimetre
	1760 yards (yd.) = 1 mile	10 decimetres (dm)	= 1 metre
		10 metres (m)	= 1 dekametre
		10 dekametres (dkm)	= 1 hectometre
		10 hectometres (hm)	= 1 kilometre (km)

AREA

144 square inches (sq. in.)	= 1 square foot	100 square millimetres (sq. mm)	= 1 square centimetre
9 square feet (sq. ft.)	= 1 square yard	10,000 square centimetres (sq. cm)	= 1 square metre
4840 square yards (sq. yd.)	= 1 acre	100 square metres (sq. m)	= 1 are
640 acres	= 1 square mile	100 square ares (a)	= 1 hectare
1 square mile (sq. mi.)	= 1 section (of land)	100 hectares (ha)	= 1 square kilometre (sq. km)
36 sections	= 1 township		

WEIGHT

16 drams (dr.)	= 1 ounce	10 milligrams (mg)	= 1 centigram
16 ounces (oz.)	= 1 pound	10 centigrams (cg)	= 1 decigram
2000 pounds (lb.)	= 1 ton (tn.)	10 decigrams (dg)	= 1 gram
		10 grams (g)	= 1 dekagram
		10 dekagrams (dkg)	= 1 hectogram
		10 hectograms (hg)	= 1 kilogram
		1000 kilograms (kg)	= 1 metric ton (t)

VOLUME

1728 cubic inches (cu. in.)	= 1 cubic foot	1000 cubic millimetres (cu. mm)	= 1 cubic centimetre
27 cubic feet (cu. ft.)	= 1 cubic yard (cu. yd.)	1000 cubic centimetres (cu. cm)	= 1 cubic decimetre
		1000 cubic decimetres (cu. dm)	= 1 cubic metre (cu. m)

CAPACITY

Liquid

2 cups (c.)	= 1 pint	10 millilitres (ml)	= 1 centilitre
2 pints (pt.)	= 1 quart	10 centilitres (cl)	= 1 decilitre
4 quarts (qt.)	= 1 gallon (gal.)	10 decilitres (dl)	= 1 litre
		10 litres (l)	= 1 dekalitre
Dry		10 dekalitres (dkl)	= 1 hectolitre
2 pints (pt.)	= 1 quart	10 hectolitres (hl)	= 1 kilolitre
8 quarts (qt.)	= 1 peck		
4 pecks (pk.)	= 1 bushel (bu.)		

Liquid and Dry

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